

<b>Project Name</b> <b>Code: 2.8</b>	<b>Enhancing Animal Production through Raising the Capacity and Capability of Vietnam's Nutritional Agricultural Laboratories</b>
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<b>Vietnam Institution</b>	IAS
<b>Project Duration</b>	July 2001 to June 2003

## **Project Description**

The ability to achieve an economically efficient livestock production system and to improve the quality of agricultural research and advice in Vietnam is dependent on the capacity of feed laboratories to provide reliable nutritional and analytical data. Vietnam's laboratories currently lack the resources and skills to meet both industry needs and the higher accreditation standards for Quality Assurance (QA) set as a Government objective. The proposed activity will assist laboratories to meet these industry needs and government goals by:

- (1) reviewing existing systems, equipment and analytical requirements
- (2) selection and documentation of analytical methods and QA systems,
- (3) addressing basic laboratory skills and expertise in QA,
- (4) development, installation and training in laboratory information systems.

These together will ensure the Vietnamese have access to a valid and accurate database of nutrient information on a wide range of Vietnamese feedstuffs used in animal feeding, thereby enabling animal industries to improve production and income by better matching what feeds provide to what animals need for most efficient growth. It will also actively encourage a greater degree of standardisation and coordination between laboratories in North and South Vietnam.

## **Objectives**

The major objective is to enhance Vietnam's capacity for rural research, development and education by improving the quality of its analytical laboratories, its skill base and systems. It also seeks to foster partnerships not only with Australian scientists but also between scientists and technicians in North and South Vietnam with the development of a comprehensive national QA Program for their agricultural laboratories.

These objectives will be achieved by:

- ◆ **Expanding skills** levels at the laboratory level with a training program that is specific to their technical needs.

- ◆ **Establishing QA programs** in the major laboratories that will improve the quality of scientific data and allow them to achieve a higher Government Quality Standard.
- ◆ **Collating nutrient data** on traditional and alternative feedstuffs into a comprehensive database that will provide the basis of feed information for educational programs for farmers and for Least Cost diet formulation by animal production extension officers.
- ◆ **Standardisation** and technical cooperation between participating laboratories in Vietnam by utilising proficiency programs, uniform training, QA and methodologies and a common recording and description system based on a reference database.

Using the 'train the trainer' model the skills and knowledge acquired by the laboratory staff trained at ARI will then be transferred to their colleagues, thus multiplying the overall skill and training levels of local technicians. Over the long term this will directly benefit agricultural research and development capability in Vietnam.

Whilst the primary focus will be on achieving a successful outcome from the 2 major laboratories, the reviewers may see value in visiting the Institute of Post-Harvesting Technology (Hanoi) and the Sub-Institute of Post-Harvesting Technology (Ho Chi Minh City) for a one day review and, also, possibly substituting one technical officer from each of the Institutes for training at ARI (in the second year) in place of one or two technical officers from NIAH (or IAS). This will have a neutral effect on the budget.

The proposed activity has a focus on those objectives highlighted in the CARD program, so that real sustainable benefits can accrue to Vietnamese farmers, both large and small-holders, and their agricultural enterprises. It aims to enhance capacity building at the laboratory level through enhancement of the skill base and the development of improved QA systems.

Subsequently, this will enhance the research and education in Vietnam and flow down to the extension and farming sectors that use this information in producing income from animal production. This activity has the potential to complement a variety of other overseas aid projects, including CARD activities, that depend on determinations of nutrient composition and animal productivity.

## Outputs and Performance Indicators

Outputs	Performance Indicators
<p>a) Establishing a QA Program that bears relevance to the needs of agricultural analytical laboratories in Vietnam and incorporating the following specific outputs.</p> <ul style="list-style-type: none"> <li>◆ Documentation of standardised methods of nutritional and feed quality assays for both research and development and commercial requests in the nutritional area.</li> <li>◆ A proficiency program and quality control system to ensure the quality of analytical nutritional results and which could be monitored by ARI.</li> <li>◆ Systems to ensure that laboratory equipment is managed, calibrated and serviced to help ensure higher standards of analytical accuracy.</li> <li>◆ QA systems to ensure a greater level of certainty with respect to sample identification and documentation etc.</li> <li>◆ Evaluation of the capacity to utilise a laboratory management computer system (LIMS) to collate, manipulate and store data and the benefits, in terms of minimised human error and maximised rigour, efficiency and reliability in the use of this data, that would accrue from using such a system.</li> <li>◆ Reviewing the range and use of scientific equipment, addressing areas of critical need with the acquisition of minor equipment items and appraising the suitability of NIR technology for feed analysis in these laboratories.</li> </ul>	<ul style="list-style-type: none"> <li>i. Manuals of methods and one summarising the overall QA program.</li> <li>ii. A valid quality control program and proficiency program (probably based on an inter-laboratory comparative testing program).</li> <li>iii. Number of technical staff undertaking training, transfer of these skills to other staff and skill level/commitment to QA by technical staff after a defined period.</li> <li>iv. Programs to manage equipment and ensure calibration on a regular basis.</li> <li>v. Systems in place to track samples efficiently.</li> <li>vi. Assessment/recommendation for the use of a LIMS system; development of a basic LIMS and training in its use and on-going development.</li> <li>vii. A report on the use of scientific equipment and the potential for NIR technology.</li> <li>viii. A functional feedstuffs database using existing values for analysed feedstuffs. Training in the use of the database.</li> <li>ix. The number of laboratories involved in the QA program and the level of cooperation and standardisation between laboratories.</li> <li>x. Commitment to the utilisation and on-going expansion of information contained in the database.</li> </ul>
<p>(b) Improving the skill levels of laboratory technicians, in particular those related to QA systems, by undertaking specific training programs in Australia and Vietnam.</p>	
<p>(c) Establishing a database of nutritional values for local feedstuffs and guidelines for the expansion of its data content.</p>	

# **PROJECT COMPLETION REPORT**

## **Executive Summary**

The project has essentially met objectives within both time and budget guidelines. Operationally the project has proceeded as planned. The three visits by the Australian scientists to the Vietnamese laboratories were successful in that the reviews of their QA systems, methods, skills and equipment were completed, audits were undertaken on each visit, training in QA, general methods, equipment maintenance and in the use of the Laboratory Information Management System (LIMS) was achieved, the LIMS system was developed and installed in both laboratories along with associated computers and software, a comprehensive workshop on QA and LIMS was conducted in Vietnam for a wide audience and the project's progress and outcomes were reviewed.

Likewise, the visits by eight Vietnamese technicians and scientists, as well as the Vietnamese coordinator of the project, to the Animal Research Institute (ARI) was successful given the knowledge and skills they acquired during the training courses. They were able to adapt this knowledge to upgrade their own QA systems and plan for a LIMS to specifically meet their needs. The additional training of an extra three months for two technicians to learn more advanced methods was arranged during this time.

It is believed that the outcomes achieved have been significant. In addition to the outcomes related to the principal objectives there have been other benefits. These include a greater level of understanding and cooperation between the laboratories in North and South Vietnam and improved networks between a number of laboratories in Vietnam and ARI. Both the Institute of Agricultural Sciences of South Vietnam (IAS) and the National Institute of Animal Husbandry (NIAH) have made substantial progress towards higher accreditation levels for QA in their laboratories. Full documentation is in place and systems have been improved. NIAH should achieve full International accreditation at the end of this year. IAS has also progressed their QA but the lack of sample throughput, due to the lack of infrastructure in the new laboratory, has restricted full implementation of QA systems and their assessment by auditing. They expect to meet higher Government standard accreditation within a few months.

The review of systems and equipment helped formulate the QA program and establish the LIMS. It assisted in helping to prioritise equipment and computing needs and their purchase and successful installation. It also identified equipment maintenance problems that we were able to assist with by providing training, some repairs and servicing equipment. These outcomes have contributed positively to instigating more effective QA systems.

Training outcomes have been quite successful. This has included the acquisition of enhanced skills in the areas of basic and advanced laboratory techniques and methods, in all aspects of QA, and in the use and understanding of LIMS. Two technicians were able to spend an additional three months at ARI undertaking training in advanced QA and methods skills as a consequence of approval to reallocate savings in budgeted travel to this exercise. Training skills, as well as information on QA, has been passed on to staff in other Vietnamese laboratories and one of these staff members was able to visit ARI as

part of the training program.. The workshop undertaken at IAS provided staff involved in the project and other staff and managers from a variety of Government and private laboratories with a wider understanding of the application and benefits of both QA and LIMS systems. The level of feedback from this workshop was positive and substantial and showed a growing interest in these subjects.

New computers, purchased locally with Project funds, were in place at IAS and NIAH and the LIMS software was installed together with hardware and software linking the analytical balances to the LIMS. Additional customisation of LIMS features has occurred and further modifications are still required. Training and practice on the ARI LIMS system occurred during the ARI workshops and has contributed to the development and planning of the systems to be used in Vietnam. This system will allow the tracking of all samples received, the automatic calculation of results, manipulation and storage of data, and reporting of results electronically and in hard copy form. This will provide the basis of a database of nutritional values for feedstuffs used in Vietnam, however, additional commitment from the Vietnamese laboratories is necessary to ensure this has universal application nationwide. Issues of common sample descriptors and managing the database need to be resolved. While the LIMS system has had a significant practical outcome, there has been a number of requests for additional modifications and customisation and it became apparent that, in order to maximise the utilisation and benefits of the system, a number of major additions to the system were required.

These requirements have arisen because of the absence of a computer network in both laboratories, a desire to install the LIMS in two associated laboratories at IAS which need to maintain some independence in their operations while having common sample registration and tracking, an ongoing dependence on paper to disseminate analytical results to customers necessitating the ability to produce detailed individually customised printed reports and an absence of any formal IT structure to provide ongoing support for either hardware or software applications within the institutes in Vietnam.

Because most of these modifications involve changes to the data structure they need to be performed onsite rather than remotely. They will be more easily implemented, with less chance of data loss or corruption, if carried out at an early stage before large amounts of data are accumulated. It is therefore recommended that-

1. The major changes to the LIMS are completed before the end of 2003.
2. Where possible that this work be carried out by the officer responsible for the initial program development.
3. Residual funds from the current project be transferred to the Vietnamese project leader for the specific purpose of these upgrades and ongoing maintenance of the LIMS.

The lead institution has performed to expectations. Financial acquittals have been undertaken accountably while reports have been submitted on time. Information relevant to contractual changes has been provided promptly and honestly. Strategic planning was comprehensive and took into account the needs of the Vietnamese Institutions. The views of all contributing staff were considered before deciding on an appropriate approach. Some flexibility was required to meet circumstances such as delays in travel and resourcing issues for the Vietnamese laboratories. Operationally the project met timeframes. Arrangements to commit savings in travel to facilitate additional training for

two technicians, who were travelling to ARI anyway, was positive for all concerned. Likewise, the planned training protocol for hands-on training at ARI, followed by application of the practical and theoretical knowledge in their laboratories, was seen to be successful.

The Vietnamese partner institution has performed well. There have been good levels of communication between the IAS and the other institutions involved in the project. Where decisions had to be made on issues such as purchasing equipment and computers etc, they have put forward their views in good faith. Whilst resourcing issues (poor infrastructure and lack of a computer network, IT support and funds for equipment maintenance etc) limited some of the outcomes, their enthusiasm to ensure that the QA and LIMS components of the project were completed as well as possible was undoubted. This involved significant commitment of staff resources to achieve this. To their credit a substantial focus was put on training during the project, and this strategy will continue into the future.

## **1. Project Description**

### **1.1 Background and preparation**

This project had its genesis in an ACIAR project developed and undertaken by research staff at ARI in association with pig researchers at various Institutes in Vietnam. The outcomes of this project highlighted the need for quality laboratory support to assist, in general, various agricultural enterprises in Vietnam and, in particular, the pig industry. Discussions with the coordinator for the Vietnamese component of this project confirmed the need to enhance the quality of nutritional analyses undertaken by Vietnam's agricultural laboratories.

Preparation steps included close consultation with the Australian Coordinators of the ACIAR project (No 9423) 'Breeding and Feeding Pigs in Australia and Vietnam'. This focussed on identifying the particular shortcomings associated with laboratory support for this pig project. Our own laboratory's experience with a trainee from this project seeking skills in amino acid analyses indicated that specific skill levels were compromising project outcomes as well as limiting the quality of results emanating from these laboratories.

A workshop was held at ARI on 22/1/01 with both current and prospective CARD project participants to discuss ideas for future projects and how these relate to DPI and AusAID priorities. Communication by email with the (future) Vietnamese coordinator, Dr La Van Kinh, established the need for such a project, given the technical limitations affecting Vietnamese agricultural nutritional laboratories. He had a genuine interest in contributing to a project addressing these issues.

In February 2001 a workshop, involving laboratory participants at ARI, distilled ideas on this project such that a draft CARD proposal was documented in late February. Copies were sent for comment to Dr Kinh and ARI laboratory staff having an interest in the project.

A final version of the project was reviewed by DPI Program leaders such that a final version was submitted to ITC on 29/3/03.

*Stakeholders* – These include the two major laboratories in Vietnam, IAS and NIAH and the Vietnamese Government Department responsible for them; the lead agency laboratory in Australia, ARI and the Queensland Department of Primary Industries; AusAID and the contracted management group, ITC and those staff having a direct input into the project.

*Beneficiaries* - The laboratories in Vietnam (IAS and NIAH) and their staff because of the enhanced quality systems in place and the increased skill levels accruing to those staff, associated laboratories in Vietnam who may acquire some of this technology and knowledge; clients of these laboratories including researchers, the Vietnamese Government and the agricultural animal feed production system. Ultimately, Vietnamese farmers and consumers will be beneficiaries.

In Australia the staff involved will acquire greater skills, the networking opportunities will be broadened and the potential for further projects will be enhanced. The Department will benefit by having a greater knowledge of a significant trading partner and exposure of its scientists to a different scientific genre.

Indirectly, both Australia and Vietnam will be beneficiaries as these projects can significantly enhance the level of cooperation, understanding and friendship between these countries.

## **1.2 Context and rationale**

This project had its origins predominantly in an ACIAR project ‘Breeding and Feeding Pigs in Australia and Vietnam’ which was completed in 2001. Outputs included the evaluation of potential alternative and traditional feedstuffs and the measurement of nutrient requirements for Vietnamese pigs. The project review recommended ‘*that a concerted effort be made to coordinate the various chemical laboratories throughout Vietnam that are capable of conducting feed analyses, in order to avoid duplication and to establish common standards*’. It was recommended that a CARD project would be the best vehicle to address this, as the need was related more to capacity and capability building rather than research. The proposed CARD project therefore seeks to enhance these outputs by improving analytical capacity and quality. The project consequently has strong links to this ACIAR project and its future outcomes.

More specifically, this laboratory took a very active role in the training of a number of Vietnamese laboratory staff, the transfer of amino acid technology and the nutritional evaluation of alternative Vietnamese feedstuffs, as part of this ACIAR project. A conclusion drawn from this component of the project was that the Vietnamese technical skill levels were below western standards. The Vietnamese Coordinator confirmed that there was an urgent need to address specific issues relating to the standard and quality of laboratory analysis, laboratory systems and staff training in his country. These problems are a consequence of a chronic under-resourcing of both staff education and training and equipment. Descriptions of samples and poor methods of storage and retrieval of analytical results often limited their effective use for the benefit of Vietnamese agriculture. Discrepancies in the results from Australian and Vietnamese laboratories may have been due to a combination of factors, including limited technical information, various levels of training, different interpretations of methodologies and, finally, varying approaches to the issue of quality control. As a consequence, the CARD project sought to address these discrepancies to benefit future pig research outcomes.

This option was the only one considered because of the direct recommendations and support from those researchers, scientists and project leaders associated with the ACIAR projects as well as the pig research program in Vietnam and the laboratories themselves. Defining the project objectives was relatively self-evident based on the above needs that were identified during the project definition stage. There were no other existing projects funded by ACIAR or AusAID that had a focus on laboratory development including QA and the use of computer-based data management.

### **1.3 Project objectives and scope at design**

This project aimed to improve the quality of agricultural research, development and education in Vietnam by improving the quality of its analytical agricultural laboratories, its skill base and systems with the development of an improved quality assurance program for their laboratories.

Specific objectives were:

- Reviewing existing systems, equipment and analytical requirements.
- Selection and documentation of analytical methods and QA systems.
- Training in basic laboratory skills and the application of QA programs.
- Development, installation and training in laboratory information management systems (LIMS).
- Initiation of a Feeds Information Database.

These will be achieved by development of appropriate QA systems, in collaboration with our Vietnamese counterparts, and extensive training at ARI for technical staff from both IAS and NIAH. This will be complemented with workshops, reviews and training in Vietnam by ARI scientists. As such, this project will address AusAID strategies by engendering a positive and cooperative partnership between the staff and institutions in both Australia and Vietnam.

The project, with a strong focus on within country training as well as external training, will improve service delivery systems by helping to build human capital thereby increasing productivity. It is believed the project will have a substantial sustainability component as these benefits will be ongoing as they are built on increasing technical knowledge and skills.

This project will address the AusAID agreed country strategy for Australian aid to Vietnam of encouraging rural development. It will assist in the area of crop and livestock production by improving the quality of livestock feed. As a consequence, it will help to alleviate poverty, particularly that associated with rural communities. The proposed program would enhance capacity building by focussing on improvements in self-reliance and quality in the area of agricultural analysis. Improvements in analytical reliability across all agricultural laboratories in Vietnam would enhance both the research and the general commercial analytical outputs in that country for both the livestock and horticultural industries. Using this improved knowledge on the nutritional value of new and existing feedstuffs fed on family farms, District Extension Officers will seek to improve the productivity of poor rural communities by reducing both the amount of feed and the ultimate cost of feeding to achieve the desired level of animal production. This will help the private sector to grow.

## **1.4 Implementation arrangements**

The Coordinator of the Vietnamese component of the project, Dr La Van Kinh, visited ARI early in the project to discuss management and institutional arrangements. Decisions on project plans were therefore taken jointly between Dr Kinh and ourselves. He kept in contact with the other institute in Vietnam (NIAH) regarding these plans and was therefore responsible for overall strategic activities in Vietnam. This included selection of Vietnamese staff to travel to Australia. The individual Institutions (IAS and NIAH) undertook operational activities such as upgrading their QA systems and training staff relevant to their own laboratory as well as making individual arrangements for the visiting Australian scientists. Dr Kinh undertook all the arrangements regarding the Workshop at IAS and was also responsible for formulating and reconciling the project budget in Vietnam.

The Australian Lead Institution was responsible for the overall financial acquittal. Monies were transferred to Vietnam solely on the basis of receipt of an invoice stipulating on what those monies were to be spent. In circumstances where substantial savings could be made or where supply in Vietnam was limited, equipment purchases were made in Australia and the equipment freighted over.

All reporting was undertaken by the Australian Institution; this was obviated by language differences and the more time consuming task of translation and writing in English by the Vietnamese. Copies were always forwarded to the Vietnamese Coordinator and were read and accepted by him.

## **2. Appropriateness of Project Design and Objectives**

### **2.1 Appropriateness of Objectives**

An ACIAR project 'Breeding and Feeding Pigs in Australia and Vietnam' identified the need for ongoing, quality feedstuff analysis to optimise the benefits from improved animal feeding in Vietnam. External reviewers of this project also identified the need to better coordinate the chemical laboratories in Vietnam to avoid duplication and establish common standards. DPI staff associated with training components of this project concluded that skill levels of the laboratory workers in Vietnam and the levels of quality control were below standard. Evaluation by the Head of the Department of Animal Nutrition and Feedstuffs (Dr Kinh) at IAS concurred with this. The Vietnamese laboratories were very keen to raise their respective levels of accreditation.

This project seeks to address these problems by undertaking a comprehensive review of the two major agricultural laboratories in Vietnam (IAS in Ho Chi Minh City and NIAH in Hanoi), training staff in laboratory QA and various analytical methods, supplying certain equipment related to laboratory QA and improving technical skills and management of this equipment, putting in place improved QA systems, supplying computer hardware and software and developing a LIMS system that will provide data to a functional feedstuffs database, and training staff in the use of this and encouraging a more coordinated approach to the laboratory services and development.

Objective No	Objective Description	Appropriateness Rating
1	Reviewing existing systems, equipment and analytical requirements.	4
2	Selection and documentation of analytical methods and QA systems.	3
3	Training in basic laboratory skills and the application of QA programs.	4
4	Development and installation of a laboratory information management system and training in its use. Initiation of Feeds Information Database.	4

## 2.2 Appropriateness of Design

Some of the particular key features of the selected project design are documented and evaluated below:

Description of Design Features	Appropriateness Rating
<i>Comprehensive training for scientists and technicians in QA and basic and advanced laboratory techniques</i> – the focus has been on training those laboratory scientists and technicians who will actually derive the most practical and applied benefits from this skills enhancement. The choice of trainees for both training programs at ARI ensured this was the case. The training program was comprehensive and practical with an emphasis on laboratory-based training. Observation at ARI and in Vietnam revealed that the skill level of the Vietnamese technicians/scientists was quite good; by rearranging budget savings we have been able to offer more advanced training opportunities at ARI, including new methods and techniques that can be applied directly in their own laboratories. The flexibility in project design allowed this option to be adopted.	5
<i>Enhanced cooperation and collaboration between the Vietnamese laboratories</i> – this has been encouraged by ensuring technicians and supervising scientists from both Institutes train together at ARI. This was arranged for both our training programs. Encouraging the involvement of technicians from related laboratories was achieved with a technician from the Soils laboratory at IAS also undertaking the training at ARI. Our workshops and presentations have highlighted the advantages of interlaboratory cooperation. We believe that, despite an apparent initial reticence to share resources, this is now more acceptable. Installation and use of the LIMS system in both laboratories will help foster this strategy. A joint workshop during the final visit to Vietnam and the initiation of a proficiency program	4

Description of Design Features	Appropriateness Rating
involving both the IAS and NIAH (and subsequently other laboratories) helped promote this. A concept of encouraging training by exchanging technical staff between Institutes in Vietnam was promoted.	
<i>Development of, and training in, the use of, the LIMS system</i> – this will have additional benefits as well as its main application of sample tracking, data storage and reporting of results. These benefits include its use as a database for feedstuff information and its applicability for reporting and manipulating nutritional data for research and extension programs	4
<i>An independent review of the Vietnamese laboratories and their systems</i> – this has provided an assessment and historical perspective of the existing QA systems used in the Vietnamese laboratories, the use, suitability and maintenance of scientific equipment and computer systems and skill levels. This has ensured that the program designed is the most appropriate and is delivered in the most efficient way. Ongoing audits have extended our understanding of these systems and the need to focus on particular areas or problems.	4
<i>Progress towards a higher level of accreditation</i> – by having a focus on this objective and monitoring progress via audits etc we were able to show there was a practical and useful outcome to this project; it was something that the laboratories could strive for. Attainment would help support the Government’s expanding role in monitoring and improving the quality of animal feeds and, in particular, human foodstuffs, to meet the exacting standards of the international marketplace. Promoting skills in QA and in specific methods will enhance this process.	4

5- Best Practice; 4- Fully Satisfactory; 3- Satisfactory overall; 2- Marginally Satisfactory; 1- Weak

### 3. Implementation Performance

#### 3.1 Project Components and Outputs

Component No.	Component Description	Outputs	Performance Indicators	Performance Rating
1	Establishing enhanced QA programs	Selection and documentation of standardised methods	Documented methods manual	4

Component No.	Component Description	Outputs	Performance Indicators	Performance Rating
		QA systems in place and documented according to Quality manual	QA systems documented and being used achieved	4
		QC and proficiency programs selected and being used	QC and proficiency program in place. Accreditation at higher level	3
		LIMS to be developed for sample tracking, reporting etc	LIMS developed and being used	4
2	Review of use of scientific equipment and systems	Proper management of equipment including maintenance and calibration	Systems to manage equipment in place	3
		Evaluation of equipment needs and purchase of items that will help QA	Review undertaken and purchase of equipment arranged	4
		Existing QA systems to be reviewed to establish needs	Interview and on-site review established needs	4
3	Improvement in skill levels	Training in Australian laboratory to acquire QA skills and better skills in lab methods	Two training programs at ARI provided – eight Vietnamese staff attended	4
		Training in more advanced methods made available for two staff	Budget savings used to permit this extra training	4

Component No.	Component Description	Outputs	Performance Indicators	Performance Rating
		Training in Vietnam and Australia in LIMS and its application and extension to nutritional database use	Extensive LIMS training undertaken in Australia and Vietnam	4
4	Establishing a LIMS system and database of nutritional values	Review LIMS needs, develop LIMS to meet needs	Practical use of LIMS in both labs	4
		Concept of feeds database promoted	Discussions with laboratory staff and some researchers undertaken	3
		Hardware and software installed to meet LIMS development needs	Hardware and software purchased and installed	4

There were two approved changes during the project that required formal variations to the Contract. One involved utilising savings in the travel budget from year 1 to allow two Vietnamese technicians to spend an additional three months, prior to their one month QA training with two of their peers, at ARI to undertake additional training in QA and in more advanced methods. This had a substantial benefit with respect to laboratory skill development; as well it promoted both friendship and understanding between peoples from different cultures. The project was also granted an extension as a result of the cancellation of the last visit to Vietnam by the Australian scientists and its eventual rescheduling. The consequences were that changes, in particular additional customisations and upgrades of the LIMS, emanating from the delayed trip, could not be optimised within the project timeframes. Meeting these commitments would help meet the project's outcomes but raised the obvious dilemma in how this could be achieved.

Major factors affecting the project included relocation of the original laboratories in Ho Chi Minh City to a new building (the IAS). This had both a positive and negative effect in that it resolved some serious workplace health and safety issues which would have mitigated against achieving higher accreditation. Facilities were improved significantly with more space and the provision of air-conditioning (albeit for only 6-7 hrs a day). This provided better environmental stability for some instrumentation. However, the new facilities lacked some basic infrastructure such that the majority of the analytical work had to be transferred to another laboratory. The upgrade of electricity, ventilation and other facilities is to be undertaken prior to Christmas 2003. As a consequence of this reduced sample throughput, the LIMS system was not fully utilised up until the completion of the project. Therefore, the practical use of the LIMS at IAS was limited.

Likewise at NIAH the laboratories were refurbished during the project's life. This provided air conditioning of some laboratories, especially those housing important instrumentation, with benefits to the stability of the environment in which they operate.

The lack of appropriate operating budgets in both laboratories meant that equipment maintenance, servicing and repair was compromised. Given the major contribution equipment makes to generating laboratory results, it is obvious this could have a negative effect on the QA program. We were able to address some of these concerns by training in equipment maintenance, providing items for calibration (eg standard weights) and helping with techniques and methods for instrument calibration. Likewise these budgetary restrictions may limit the laboratory's access to quality chemicals, proper QC materials, involvement in proficiency programs, basic equipment for methods and appropriate calibrations of balances and pipettors etc.

The information technology capabilities at the laboratories were limited. This was despite the fact that the staff have a substantial interest in computer use and a dependence on its use. There were no networking capabilities, poor management of anti-virus software, and limited IT support at a central level. These factors limited the potential benefits that could be achieved from the use of the LIMS system

### **3.2 Project Outcomes**

Both laboratories have made substantial progress towards higher accreditation levels for QA in their laboratories. Full documentation is in place and systems have been improved. NIAH have had a preliminary audit by the Government agency responsible and indications are that they should achieve full International accreditation at the end of this year. Our audit of this laboratory highlighted a number of minor issues that we believed still needed to be addressed. IAS has also progressed their QA but the lack of sample throughput due to the lack of infrastructure in the new laboratory has restricted full implementation of QA systems and their assessment by auditing. These items are discussed in the previous Section. They expect to meet higher Government standard accreditation within a few months.

The review of systems and equipment provided the framework for formulating the QA program and establishing the LIMS. It assisted in helping to prioritise equipment and computing needs and their purchase and successful installation. It also identified equipment maintenance problems that we were able to assist with by providing training, some repairs and basic service tools. These outcomes have contributed positively to formulating more effective QA systems. More resources are needed at the Vietnamese Government level to resolve problems with the funding and use of high technology equipment. These issues are discussed under Section 3.7 (Constraints within Vietnam).

All of the training courses have been successful. The attainment of enhanced skills in the areas of basic and advanced laboratory techniques and methods, all aspects of QA, and the use and understanding of LIMS has been a positive outcome. This training has been passed on to staff in other laboratories and one of these staff members was able to visit ARI as part of the training program. Her laboratory, the Soils Laboratory, is seeking improvement in QA. The workshop undertaken at IAS provided staff involved in the project and other staff and managers from a variety of Government and private laboratories with a wider understanding of the application and benefits of both QA and LIMS systems. The level of feedback from this workshop was positive and substantial

and showed a growing interest in these subjects. Strategies, such as the exchange of staff between laboratories for training purposes, were discussed with the supervisors in the Vietnamese laboratories. Funding needs to be committed to maintain a high level of training.

New computers, purchased locally with Project funds, were in place at IAS and NIAH and the LIMS software was installed together with hardware and software linking the analytical balances to the LIMS. Additional customisation of LIMS features has occurred and further modifications are still required. We have responded immediately to a number of user difficulties. All of the trainees were able to observe and practice on the ARI LIMS system during the ARI workshops and have contributed to the development and planning of the systems to be used in their laboratories. This included extra development work to provide Vietnamese script input for their reports and feedstuff descriptions and self-guiding user interfaces. While this has been a significant practical outcome there have been a number of a number of requests for additional modifications and customisation and it became apparent that in order to maximise the utilisation and benefits of the system a number of major additions to the system were required.

These requirements have arisen because of the:

- a. absence of a computer network in both the northern and southern laboratories.
- b. desire to install the LIMS in 2 associated laboratories at IAS which need to maintain some independence in their operations while having common sample registration and tracking.
- c. ongoing dependence on paper rather than electronic media to disseminate analytical results to customers necessitating the ability to produce detailed individually customised printed reports.
- d. absence of any formal IT structure to provide ongoing support for either hardware or software applications within the institutes in Vietnam.

Because most of these modifications involve changes to the data structure they need to be performed onsite rather than remotely. They will be more easily implemented, with less chance of data loss or corruption, if carried out at an early stage before large amounts of data are accumulated. It is therefore recommended that:

- The major changes to the LIMS are completed before the end of 2003.
- Where possible that this work be carried out by the officer responsible for the initial program development.
- Residual funds from the current project be transferred to the Vietnamese project leader for the specific purpose of these upgrades and ongoing maintenance of the LIMS.

One of the planned applications of the LIMS system involved utilising it as the basis of a database of nutritional values for feedstuffs used and analysed in Vietnam. Its use for this purpose was demonstrated to laboratory staff and some researchers but at this stage the commitment to furthering this was only at the initial stages. This was because of the lack of data on the existing LIMS system, particularly at the IAS, the need for a coordinator to manage this database including decisions and agreement on common descriptors for samples and results, the existence of at least one basic nutritional database (that could be incorporated into the new proposed system) and the lack of consultation with a range of

researchers to discuss their needs. Because this was beyond the range of the project, this issue was left with the Vietnamese coordinator with our commitment to contribute to helping where appropriate, including providing an example of the ARI nutritional database.

### **3.3 Sectoral Impact**

There was an excellent gender balance existing with respect to laboratory employees at both IAS and NIAH in Vietnam with a substantial number of female employees associated with the project. Women were therefore deriving substantial benefits from the project, in particular important skills in QA, laboratory methods, instrumentation, computing, LIMS systems as well as project management. Improved English skills and a greater level of understanding of another culture were attributes also enhanced by participation in this project. At both laboratories, across all levels, including upper management levels, females were well represented. It was anticipated that this situation would continue into the longer term.

Outcomes from this project will enhance community benefits over the long term as the improvement in accreditation standards ensures analytical outputs are of a higher quality with consequent improvements in agricultural outcomes. Given that the majority of participants in the agricultural sector are poor peasant farmers, then the benefits should accrue to this relatively disadvantaged group.

### **3.4 Costs and Financing**

Costs actually incurred were generally within the range of that estimated at design. This applies to both the Lead Institution and the Vietnamese partner institution. There were some delays in the acquittal of some items of equipment between years 1 and 2 of the project. This was partly a consequence of our trying to ensure that scientific equipment was purchased as cost-effectively as possible. Availability also influenced decisions and, typically, this meant purchasing this equipment in Australia. In contrast, computing equipment was purchased more cost-effectively in Vietnam.

Travel costs were typically over-estimated because of arrangements undertaken for the planned visits by both the Vietnamese collaborators and the Australian scientists. These arrangements, which were based on local knowledge, included utilising establishments that provided accommodation or meals more cheaply than initially estimated.

Airfares were marginally cheaper than planned, as was local travel because of personal offers to provide daily transportation to Institutes for work purposes. As noted elsewhere and in Variations of Contract, these savings were put to effective use by sponsoring additional training for the Vietnamese technicians. It has been highlighted elsewhere in this document of the potential use of savings from year 2 travel for funding improvements in the LIMS system in Vietnam.

### **3.5 Monitoring of project**

Monitoring of project outputs was quite rigorous. Whilst it was impossible to cover every operational activity, major operational objectives were monitored at each laboratory in Vietnam by the respective coordinators and in Australia via email queries and comments on issues, particularly involving application of the LIMS, method adaptation and equipment purchases and operation.

Major objectives were effectively monitored by the Australian scientists on each of the three visits to the Vietnamese laboratories over the life of the project. The strength of this approach was that the visits involved comprehensive reviews of all the project outcomes for the preceding period, as well as formal and documented audits of the QA systems. In this latter case progress in meeting documentation deadlines and putting individual components of the QA system in place were determined according to a fully organised and documented audit. Monitoring progress in the application of the LIMS was effective because it was done in a hands-on fashion involving the Vietnam users. These visits also allowed consultation with the Vietnamese coordinators so that higher level issues could be assessed.

Financial monitoring was undertaken using the standard DPI system. This system permitted full accountability of funds committed to the project. Funds were repatriated to Vietnam on the basis of invoices from the Vietnamese coordinator that itemised what the funds were to be used for. While not having access to the Vietnamese accounts (which could be judged to be a weakness), we were able to inspect in the Vietnamese laboratories new equipment, computers and software purchased by the project.

### **3.6 Technical Assistance, Training and Capacity Building**

Vietnam's agricultural nutritional laboratories have increased the efficiency, quality and range of their outputs as a result of this project. Their capacity to help Vietnam's agricultural sector, in particular the animal feedstuffs sector, will consequently increase. This assessment follows from the improvement in technical skills and capabilities, the quality assurance systems, the range and maintenance of equipment and the computer systems to handle sample tracking and report and data management. These improvements are measurable as indicated by the audits undertaken and the assessment by Government officials for laboratory accreditation purposes. The NIAH laboratory will achieve accreditation at the international level by the end of the year while the IAS has taken significant steps towards achieving higher accreditation levels.

These improvements will boost both the quality of research and analytical services and client confidence in the quality of feed results and available local feedstuff knowledge used by district extension staff. Associated laboratories - the Institute of Post-Harvesting Technology and the Sub-Institute of Post-Harvesting Technology, will benefit by becoming involved as future partners in this program.

The project team has performed particularly well. Training in Vietnam typically involved all members of the laboratory and the selection of those for training in Australia seemed to be equitable with similar numbers from North and South Vietnam. Staff were dedicated and committed to their work and the project. Their close involvement in the project, particularly those who came to Australia, meant that they had real ownership of the outcomes. This was enhanced by the strong Vietnamese work ethic. Recruitment of staff with good basic laboratory and computing skills helped the delivery of training, especially in Australia. The only negative was the variation in English speaking and comprehension skills across the group of trainees. This was unavoidable but it did result in somewhat slower understanding of training presentations and slower development of the LIMS software.

Assessment of the Australian project team was positive in all respects. Two original members had to be replaced during the project as a consequence of resignations. This had

little impact on the project's operations as they were replaced quickly (in one case) and, in the other, another staff member on the project took on the additional duties of his colleague.

Management of the project teams at each laboratory has been highly satisfactory with managers involving all staff in the training program and having a vital interest in improving the laboratory's laboratory outputs and their quality. Each of the managers from the Vietnamese laboratories visited ARI to participate in the training or in the design and planning of the project.

It is believed that relationship between the Lead Institution and the Vietnamese partner Institution was both productive and collaborative. Issues relating to strategic and operational plans were discussed openly and opinions sought and given freely. Feedback from Vietnam on draft and final reports was limited, however this was put down to the increased time required to interpret and translate into English.

### **3.7 Management of Constraints, Issues, Risks and Change**

There were a number of difficulties or constraints and in each case the actions and suggestions to resolve these were considered after consultation with the whole team. These included:

- Language difficulties; there being a range of skills across the training group. Younger members typically had a better knowledge of English, especially speaking skills. Reading and writing skills were always much better than speaking skills. We became better prepared with successive visits by having a number of strategies in place to help deal with this. Likewise staff on subsequent visits had a better background in the subject material by being exposed to the training in Vietnam. These strategies included assessment by the trainer of their understanding by repetition of the material taught and asking questions, having a mix of trainees of different age groups and language skills who can discuss the subject material being taught as a group, evaluation of language skills of trainees in Vietnam by the DPI scientists during their visits and using the services of a Vietnamese-born technician at ARI to help in some areas of training and evaluate learning difficulties. Longer term strategies include ensuring that future trainees undertake English speaking courses.
- The loss of two Australian team members due to resignations, could have potentially affected the training program. This was avoided by having one position quickly replaced and by negotiating with a colleague to voluntarily increase his input into the program for the other. In both cases skills and areas of interest paralleled those of the former team members.
- There is no provision within the new laboratory facilities, at either site, for computer networks. This lack of a modern and efficient IT system in the Vietnamese laboratories is a constraint. For example, there is a clear need to have a laboratory local area network (LAN), internet access and to have strategies in place for back-up of data and protection against viruses. Improved cooperation between the Institutes is essential to encourage the formation of a *National* Feeds Information Database, rather than having a number of local ones. A connection between laboratories either via the Intranet or wide area network (WAN) would also greatly contribute to the ongoing benefits of this project.

- There were some delays, because of visa problems, in the arrival of the Vietnamese technicians undertaking the extended training. This coincided with the Christmas period. Likewise, the arrival of the other two senior staff in February coincided with preparations for a full NATA review of laboratories that affected the flexibility of input to the program by two of the DPI staff associated with the project. Better planning would allow for an improved training structure.
- The final trip to Vietnam by the Australian scientists, planned for 28 March to 16 April, was postponed at the last minute by significant concerns within DPI regarding overseas travel quotas, combined with uncertainty about travel to Vietnam as a consequence of the SARS epidemic. This trip was rescheduled for the 1-22 August. The effects of this were threefold:
  1. This required an extension to the project, primarily to allow time for reporting. Ideally extra time would be necessary to finalise any further changes, particularly additional enhancements or upgrades of the LIMS system, emanating from this final visit. Being forced to take the visit in the final weeks of the project did not allow this.
  2. There were substantial inconveniences (administration, travel and accommodation arrangements etc) that were borne primarily by the Vietnamese coordinator.
  3. There was a degree of embarrassment to ourselves over the sudden cancellation of the trip. Since the Vietnamese did not understand the nature of the cancellation, this event may have reflected negatively on their perception of our commitment.

#### *Constraints within Vietnam*

A major issue that impacted on the laboratories' abilities to fully meet the project's objectives was the lack of resources to support these laboratories. Examples of this included:

- There was a lack of ongoing funds particularly for operating (including the purchase of quality chemicals) and maintenance of equipment. This was a major issue that compromised both quality of results and safety for laboratory workers.
- Funds provided by overseas aid projects for new equipment are often spent without regard to (a) the overall need of the primary laboratories and (b) the resources required to fund the ongoing maintenance costs of the equipment. This seems to be a consequence of overseas funding bodies providing resources for capital equipment that is linked to specific research programs. Better coordination and sharing of equipment would address this issue.
- Quality assurance suffers as a consequence of lack of analytical standards and quality controls materials, poor equipment maintenance and a significant lack of operating funds.
- Workplace health and safety was compromised as a result of lack of (1) proper laboratory facilities, (2) safety equipment and (3) maintenance of equipment and safety being only a minor issue in the existing QA program.

The refurbishment of the NIAH laboratory and the acquisition of new laboratories at IAS resolved some of these problems during the course of the project. The use of project funds, to meet budget commitments, for the purchase of equipment related to QA, the

acquisition of calibration items and the provision of QC standards and the arrangement of a proficiency program have helped to resolve some of these issues.

There still remains a need to provide the laboratories at IAS and NIAH with access to a computer network. This would permit more effective use of the LIMS by providing access from computers, both within the laboratory and also within other laboratories at the same Institute. We discussed this issue with higher levels of management at the Institutes by reference to the advantages to efficiency in introducing computer networking. Promises were made to consider funding this in the future.

At the outset it was obvious that there was a need for more collaboration between the Vietnamese laboratories. The project has definitely helped to achieve this by providing joint training in Australia, undertaking a workshop at IAS involving staff from IAS and NIAH at IAS, encouraging sharing of resources and ideas across laboratories, considering some uniformity of methodology and use of comparable equipment, employing similar QC programs and software to manage the analytical data and encouraging training in Vietnam by swapping staff across both Institutes (and other laboratories). There is also a need for greater cooperation across the Institutes regarding the potential development of a national feeds information database, rather than having a variety of local ones. Whilst this may be a consequence of a limitation of resources, it is appropriate to plan collectively on how to best achieve this. We have encouraged discussion of this issue at each of our visits to Vietnam. It is only by pointing out the advantages of such a system to end users and other beneficiaries that its adoption will be progressed. This was also emphasized at the final workshop at the IAS.

### **3.8 Project Management**

The management performance of the Lead Institution, ARI, Queensland Department of Primary Industries) has been good. Strategic and operational; planning has been comprehensive and operationally the project has met timeframes and accountability requirements. Planning has involved all team members. Variations to the contract because of a major delay to travel for the final visit to Vietnam and a contract change, where we proposed additional training by Vietnamese technicians in Australia because of substantial budgetary savings in travel costs, were managed appropriately and efficiently. Outcomes from a particular trip or training event were used to determine an appropriate approach for the next trip or exercise so the issue could be addressed or training improved. Team members believed that this contributed to a better level of training overall. The Vietnamese trainees' assessment of the effectiveness their QA training program at ARI has been encouraging.

During the life of the project one of the team members resigned from DPI. Negotiations successfully arranged for a colleague, already contributing to the project, to increase his input to cover the loss of this person for the period of the training. ITC was notified of this.

DPI played a strong role with the Vietnamese participants regarding the purchase of equipment and computers. While there were some differing opinions about respective needs in the two laboratories and what constitutes capital items, equipment purchases were decided upon fairly by focusing on the aims of the project and stressing the importance of achieving equity across both Vietnamese laboratories.

### *Vietnamese Partner Agency*

The Vietnamese Partner Institution (IAS) has performed well by ensuring planning and operational aspects of the project have proceeded smoothly. This has included local purchase of equipment and computers. Visits to Vietnam by the Australian scientists and travel arrangements were always impeccably organised. It is of interest that cultural differences provided different perspectives to some issue eg items identified as important to the Australians were not always considered as important from the Vietnamese perspective.

The following specific inputs are considered:

- Allocation of staff resources – the choice of staff for training by the Vietnamese partners has focussed on those staff actually engaged in the technical side of the laboratory operations. One technician from a related laboratory (the Soils lab at IAS) participated, thereby encouraging the extension of this project's outcomes to a wider base. Arrangements to include staff from both Institutes have helped to generate a collaborative spirit between the laboratories. Typically, these staff have established a strong friendship with their counterparts in North or South Vietnam and has contributed to breaking down barriers between people from both regions.

*Rating 4*

- Information for reviews, auditing and monitoring - details of existing methods, operations, and the QA systems have been provided openly and in a constructive manner by staff from both Institutes.

*Rating 4*

- Identification and prioritisation of equipment needs – the Vietnamese partner institution provided guidance regarding the negotiation for prioritisation of equipment needs as a result of limited State funds for operating.

*Rating 3*

- Assessment of the needs for the LIMS system - the need for particular customisations, technical enquiries regarding problems and the need for relevant hardware and software have been communicated relatively well.

*Rating 4*

## **4. Performance and Outcomes**

### **4.1 Assessment of Performance Against Objectives and Design**

Operationally the project has proceeded as planned in the original proposal except with some variations in dates. The Vietnamese Coordinator visited the Australian laboratory in August 2001 to discuss final plans for the project, to review Australian QA and LIMS systems and to assess the best way to transfer this knowledge. Two Australian scientists visited the IAS and NIAH laboratories in September of the same year to evaluate their laboratory and QA systems, review methods and equipment appropriate to the QA program including computer systems and to evaluate technical skill levels and knowledge. Initial feed samples were exchanged as part of the process to develop a

proficiency program between all the laboratories. As a result of this, all the existing Vietnamese systems were reviewed, in light of the need to upgrade these to meet higher accreditation standards. Training programs were devised, examples of QA documentation prepared and development of a LIMS system appropriate to their needs was commenced. Two technicians commenced training on laboratory skills in more advanced methods and QA at ARI for three months prior to a month's training on QA and LIMS with two of their colleagues in February 2002. This training, involving staff from NIAH and IAS, allowed them to extend this learning to their peers on return to Vietnam. The Australian scientists returned to Vietnam in September 2002. A version of the LIMS system was introduced to both laboratories, installed and tested and training in its use provided. The purchase and installation of equipment, computers, peripherals and software was facilitated. Audits were undertaken in each laboratory to monitor progress in adoption of QA systems. In November 2002 the final group of technicians/scientists from Vietnam arrived for their one month's training in QA, LIMS and laboratory skills. During this time customisation and maintenance for the Vietnamese LIMS systems continued at ARI. Meanwhile the Vietnamese laboratories undertook improvement in their QA systems, documentation and evaluation of the LIMS system. The final visit to Vietnam by the Australian scientists was completed in August 2002 to finalise evaluation of the QA system via an audit, to provide additional customisations of the LIMS and training, and review the project's outcomes with the Vietnamese collaborators. A comprehensive workshop was provided to all project staff in Vietnam as well as managers and supervisors of other Government and private laboratories.

The following outcomes have been achieved:

- QA systems in each laboratory have been upgraded significantly as indicated by the level of associated documentation and the application of these systems in everyday laboratory use. The NIAH laboratory, after a final inspection by the Government agency should achieve accreditation at the International Level by December 2004; the IAS laboratory is confident of achieving accreditation at a higher level (Government level) by the new year. Accreditation at the International level would be expected in a couple of years.
- Skill levels of staff have been improved. This includes the skills and understanding of QA systems, the application and use of LIMS systems and both basic and advanced laboratory skills associated with standard and more technologically advanced methods.
- Scientific and calibration equipment, computers, peripherals and software have been purchased and are being used. These will provide benefit in the immediate and longer term
- The LIMS has been installed and customisations and upgrades been undertaken. Sample tracking and automatic data downloading from balances is operational. Staff have been trained in its use and its basis as a nutritional database
- Exchange of samples between the Australian and Vietnamese laboratories has provided a genesis for development of an interlaboratory proficiency program.

#### **4.2 Sustainability**

It is anticipated that the majority of benefits emanating from the project will be relatively sustainable. The following factors are considered:

*Institutional* – We have actively encouraged a sense of cooperation between the Vietnamese Institutes and tried to promote a culture of equity in resource allocation from the project. The two Institutes have tended to act in a more independent manner, partly because of historical reasons and but also because of different resourcing levels that have caused the laboratories to be at different levels of accreditation. We have, however, found some evidence of a better level of sharing of resources between laboratories within the same Institute. We have emphasized the importance of this because it helps to achieve outcomes and improve knowledge and problem-solving attributes. The inclusion of mixed teams from the 2 institutes and a trainee from a related laboratory in the Australian training program helped not only from the point of view of technical collaboration but also from a social and cultural perspective.

*Rating 3*

*Financial* - This is a major issue. Whilst there is some new funding for laboratories there is a chronic shortage of ongoing operating and maintenance funds. To date there is no evidence of new government-funded capital equipment in either laboratory. The new laboratories at NIAH are functioning, whilst those at IAS are still awaiting completion of much of the infrastructure. Consideration should be given to operating on a fee-for-service basis for external agencies.

*Rating 3*

*Technical* – The above comments are supportive of the long-term development and retention of technical skills. The fact that the two major Institutes are already involved in a QA program and are keen to upgrade their level of accreditation, combined with the outcomes from this project, should provide a long-term incentive for the future improvement of quality assurance in Vietnam’s agricultural laboratories. Management and staff at both NIAH and IAS are particularly willing to adopt the new LIMS technology.

*Rating 4*

*Environmental* – Issues such as the proper use of scrubbers to remove toxic fumes from laboratories, the choice of less-toxic chemicals as alternatives in current methods and the appropriate disposal of chemicals will improve environmental outcomes. The construction of new laboratories at both the IAS and NIAH will also ensure progress towards this ideal.

*Rating 3*

*Social/Community* – outcomes from this project will enhance community benefits over the long term as the improvement in accreditation standards will ensure analytical outputs are of a higher quality with consequent improvements in agricultural outcomes. In parallel, there should be a greater confidence in addressing and measuring the quality of human feedstuffs.

*Rating 3*

*Gender* – Staff at the laboratories directly involved in this project were predominantly female and therefore they were the primary beneficiaries of the training and skilling opportunities provided by the project. This trend should continue into the future. We also noted that females were well represented at supervisory levels. In the research groups we visited, females were under-represented.

*Rating 4*

### **4.3 Development Impact**

The improvement in Quality systems and skills within the laboratories and their accreditation at a higher level than previous (currently confirmed at NIAH) will provide researchers, commercial clients and farmers with more reliable nutritional information on feedstuffs.

The improvement in the skill base with the additional training in Australia will extend the range of analyses the laboratories are capable of providing for clients and the Vietnamese feedstuff industry. This increased confidence will be supplemented with training for other laboratory staff associated with new ongoing projects (eg ACIAR). Over the longer term this skill enhancement will be self perpetuating with skills being transferred to peers.

The installation of the LIMS system and associated software for electronic data transfer will provide the laboratories with the capacity to store and interrogate nutritional data for feedstuffs. The availability of this information on a range of feedstuffs will have long term benefits for the Vietnamese agriculture sector.

Within a few years it is anticipated that associated laboratories within the Vietnamese Government Agriculture Ministry will undertake and complete the adoption of this QA program. This will ensure that all laboratory outputs for research projects and client requests meet appropriate quality standards.

## **5. Conclusions**

### **5.1 Overall assessment**

It is believed that the project's achievements have been substantial. Most of the documented objectives have been met to a reasonable degree. In both laboratories methods have been documented to a standard that at least meets the next highest level of accreditation. All relevant sections of the quality manuals have been completed and checked. Systems have been put in place to account for all those factors important for having a viable QA system; this includes a quality control system, reporting, training, corrective actions etc. The LIMS system was successfully installed in both laboratories and modifications to meet specific needs were undertaken. This is an integral part of the QA system as it allows for tracking of samples, automatic downloads of analytical data, reports that meet appropriate formats, and complete and retrievable storage of data. Assessment and upgrades of the system at IAS have been hampered by a lack of sample input. This has resulted from limited use of the laboratory as a consequence of necessary infrastructure being incomplete, following recent construction of the new laboratory.

Skill development as a result of training in Vietnam and in Australia has met expectations. All staff have had training and experience with the QA system requirements. All have had some training in basic methods and some have had additional

training in more advanced methods. Some of these new methods have been adopted into the Vietnamese laboratories.

Monitoring of the laboratory's progress by system and technical audits, undertaken on each occasion by Australian scientists visiting these laboratories, proved to be successful. These audits highlighted areas that needed further attention, as well as identifying workplace health and safety issues.

Equipment such as balances, calibration weights together with the IT components (software, computers and printers) were purchased and incorporated successfully into the laboratory where they have improved laboratory efficiency as well as contributing significantly to QA requirements. The use of general laboratory equipment has been reviewed and guidance and training given on maintenance and basic repairs for items such as HPLCs and atomic absorption spectrophotometers. This has been a useful outcome, as the laboratories seemed to lack the skills and resources to meet this need.

Project design could have been enhanced by our documenting more clearly the longer term resources needed to support the LIMS. In particular, it required identification of a person having the knowledge and skills to be responsible for the longer term maintenance and upgrading of the LIMS. The system was always going to need maintenance and upgrading as additional needs emanated from the laboratory service.

The objective of attempting to extend the use of the LIMS to the development of a functional feedstuffs database made only limited progress because the LIMS systems, though functional, have accumulated limited data over the life of the project and there were uncertainties regarding decisions as to who would be responsible for finalising the Vietnamese requirements for such a database and how this would be resourced. Also there was limited involvement of nutrition researchers in deciding the best way to arrange this data and little input on decisions on uniformity feedstuff description.

A number of recommendations regarding additional modifications to the LIMS are documented. These arose from the number of requests for additional modifications and customisation. It became apparent that in order to maximise the utilisation and benefits of the system a number of major additions to the system were required. These requirements emanated from the:

- absence of a computer network in both the northern and southern laboratories.
- desire to install the LIMS in 2 associated laboratories at IAS which need to maintain some independence in their operations while having common sample registration and tracking.
- ongoing dependence on paper to disseminate analytical results to customers necessitating the ability to produce detailed individually customised printed reports.
- absence of any formal IT structure to provide ongoing support for either hardware or software applications within the institutes in Vietnam.

Because most of these modifications involve changes to the data structure they need to be performed onsite rather than remotely. They will be more easily implemented, with less chance of data loss or corruption, if carried out at an early stage before large amounts of data are accumulated.

Recommendations are-

- That the major changes to the LIMS are completed before the end of 2003.

- Where possible that this work be carried out by the officer responsible for the initial program development.
- Residual funds from the current project be transferred to the Vietnamese project leader for the specific purpose of these upgrades and ongoing maintenance of the LIMS.

*Provide general comments on issues for consideration with respect to the continuation or extension of the Viet Nam Capacity Building for Agriculture and Rural Development Program.*

I feel that the direct and immediate benefits emanating from the outcomes of the CARD projects are positive and often substantial. The emphasis on education, knowledge and technical training provides the recipients with both the self assurance and the skills to reshape and direct their own future, rather than being dependent directly on skills and resources from a donor country.

Whilst on occasions these benefits may be difficult to evaluate, there is always a substantial indirect benefit to be gained by the friendship and goodwill generated from these projects. We found that the meeting and working together of scientists from Australia and Vietnam in these cooperative training projects helped develop imbue a sense of cooperation and friendship. This unity of spirit, by having science as the focus, may well break down political and cultural differences such that in the longer term social acceptance is enhanced and economic relationships are improved.

## **5.2 Lessons Learned**

With respect to laboratory analytical skills it is obvious that the Vietnamese staff were keen to adopt and learn the latest techniques and, where possible, purchase the associated technology, despite the fact that it was often very expensive. There were examples in the Vietnamese research laboratories where this approach was adopted yet, often, the technology/skills were not being used effectively because:

1. The skills had been acquired some time ago and were partly forgotten because there was insufficient operating budget to support the technology or no research being funded in that area.
2. There was a lack of more basic, though essential, equipment necessary for prior preparation of samples etc before analysis via the new technology.
3. Inappropriate planning of laboratory needs have lead to significant delays in laboratory outputs. This is primarily at the level of meeting basic infrastructure needs.
4. There was a basic lack of understanding and commitment to instrument maintenance and repair and presumably a lack of funding for this maintenance.

The fact that the populace have a substantial interest in education, particularly of the youth, is compatible with one of the main objectives of AusAID. It is therefore appropriate that AusAID promotes and funds skill and knowledge development in this country as it will produce substantial positive benefits in the future.