

Project Name Code: 2.13	Development of an Improved Capability for the Control of Classical Swine Fever on Large and Small Pig Farms
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Australian Institution	CSIRO Livestock Industries Australian Animal Health Laboratory
Vietnam Institute	NaVetCo
Project Duration	July 2001 to June 2003

Project Description

The project is to transfer a small suite of laboratory technologies to develop a capability in Vietnam for the diagnosis and control of the major disease of pigs, causing financial loss to both large and small scale farmers. The project inputs do not finish at that point, but further include the provision of training to ensure that the benefits to be derived from the enhanced technological capability will be available to farmers. Hence the project spans a number of activities from the laboratory to the farm

Objectives

- a) To enhance cell culture capability at NAVETCO
- b) Transfer CSF diagnostic capability from AAHL to NAVETCO, including cell culture based techniques of virus isolation and serum neutralisation tests (NPLA) for the detection of antibody, as well as immunoassay techniques such as antigen and antibody detection ELISA. Transfer ELISA technology from NAVETCO to DAH laboratories as requested by DAH.
- c) Using cell culture at NAVETCO, make a collection of isolates of CSF viruses from cases of CSF disease on farms. At NAVETCO and AAHL use molecular techniques to assess strain variation. Select a subset of isolates for further study.
- d) Refurbish facilities for animal experimentation at NAVETCO if necessary. Develop a standardised challenge model for experimental production of CSF in pigs. Test the subset of isolates of virulence and test the efficacy of the NAVETCO CSF vaccine in protecting against challenge.
- e) Train NAVETCO and DAH staff in outbreak investigation for the investigation of cases of CSF on farms, including sampling strategies and data collection. Develop a register of apparent and proven cases of vaccine failure, and develop strategies to analyse causes.
- f) NAVETCO will use the new cell culture capability to produce an experimental cell culture based on CSF vaccine, with the new objective of replacing existing products and procedures for their use under both large and small scale farming conditions.
- g) Develop pig health care information and training packages for large and small scale pig farmers and their veterinary advisors, with emphasis on CSF prevention and prevention of other infectious diseases.

Outputs and Performance indicators

Outputs	Performance Indicators
<p>◆ Establish an enhanced cell culture capability in the NAVETCO laboratories.</p> <p>Output: Cell cultures for virus propagation, isolation from field samples and for serology by NPLA</p>	<p>i) Cell cultures in large and small flasks and in microtitre plates routinely available, without bacterial or fungal contamination.</p>
<p>◆ Transfer CSF diagnostic capability from AAHL to NAVETCO, including cell culture based techniques of virus isolation and serum neutralisation tests (NPLA) for the detection of antibody, as well as immunoassay techniques such as antigen and antibody detection. ELISA. Transfer ELISA technology from NAVETCO to DAH laboratories as requested by DAH.</p> <p>Outputs: Functional tests as described, at NAVETCO and the DAH lab in Ho Chi Minh City.</p>	<p>i) Results; internal quality control sheets for examination, correct results ion external profeiciency tecting organised by AAHL, CSF virus isolates</p>
<p>◆ Using cell culture at NAVETCO, make a collection of isolates of CSF viruses from cases of CSF disease on farms. At NAVETCO and AAHL use molecular techniques to assess strain variation. Select a subset of isolates for further study.</p> <p>Outputs: A panel of CSF virus isolates, and a subset for further study</p>	<p>i) A register of field samples at NAVETCO CSF virus isolates, viral RNA submitted to AAHL, molecular analyses available, a subset of isolates nominated.</p>
<p>◆ Refurbish facilities for animal experimentation at NAVETCO if necessary. Develop a standardised challenge model for experimental production of CSF in pigs. Test the subset of isolates for virulence, and test the efficacy of the NAVETCO CSF vaccine in protecting against challenge.</p> <p>Outputs: CSF virus isolates tested for virulence, efficacy of current vaccine against strains of virus in the subset tested, a challenge model available for future work.</p>	<p>i) Experimental records of the experimental infections, a protocol for the challenge model recorded, including details of virus strain, dose, merthod of application, clinical observations and end points for animal use.</p>

<p>◆ Train NAVETCO and DAH staff in outbreak investigation for the investigation of cases of CSF on farms, including sampling strategies and data collection. Develop a register of apparent and proven cases of vaccine failure.</p>	<p>ii) Instruction notes developed by the project for reference of investigation teams, records of farms investigated by NAVETCO of DAH, a register of field samples received at NAVETCO, a published analysis of information from a number of farms, extension advice (advice sheets for large and small scale farmers?) on CSF vaccine use.</p>
<p>◆ NAVETCO will use the new cell culture capability to produce an experimental cell culture based CSF vaccine, with the objective of replacing existing products. The challenge model developed above will be used in efficacy studies.</p> <p>Outputs: A cell culture derived CSF vaccine that is effective and cheap to produce.</p>	<p>iii) Laboratory records on selection of a strain, seed lotting, innocuity testing, animal testing.</p>
<p>◆ Train NAVETCO in conduct of field trials of CSF vaccines, to identify appropriate products and procedures for their use on both large and small scale farms.</p> <p>Outputs: Instruction notes developed by the project on procedures for vaccine field testing, data on the effectiveness and recommended use of existing product, and any newly developed product.</p>	<p>iv) Instruction notes available, NAVETCO staff trained, records of on-farm studies available, product information sheets amended if necessary.</p>
<p>◆ Develop pig health care information and training packages for large and small scale pig farmers and their veterinary advisors, with emphasis on CSF prevention and prevention of other infectious diseases.</p> <p>Outputs: A pig health care information and training packages for large and small scale pig farmers and their veterinary advisors.</p>	<p>v) Records of consultation with focus or study groups of large and small scale pig farmers and/or their veterinary advisors as to appropriate methods, design document(s) for a pilot study(s), written recommendations,</p>

COMPLETION REPORT

Executive Summary

The project achieved its major objectives; the transfer and of Classical Swine Fever (CSF) diagnostic technologies to the National Veterinary Company (NAVETCO) and ELISA technologies to the Department of Animal Health (DAH), a preliminary survey of the effectiveness of CSF vaccines used around Ho Chi Minh City (HCMC) and training in disease investigation and control. NAVETCO scientists received training at AAHL and NAVETCO in ELISA technologies, molecular techniques, histology and immunohistochemistry, tissue culture techniques, including those for virus isolation and serology and laboratory quality assurance. DAH scientists received training in ELISA technologies and an introduction to cell culture and molecular techniques. CSF diagnostics have been established at NAVETCO, including an enhanced cell culture capability. CSFV ELISA technology was transferred to the DAH Laboratory from NAVETCO, further training is recommended to establish these techniques and CSF diagnostics at DAH. A workshop on CSF diagnostics, disease investigation, post mortem techniques, sample collection, farm biosecurity, CSFV vaccines and control of CSF was ran by AAHL and NAVETCO, at NAVETCO, and was used to provide information and training in pig health with emphasis on CSF prevention and prevention of other infectious diseases. Twenty-two participants took part in the workshop with a further 30 veterinarians and senior DAH officials attending the final day of the work shop for discussions on the control of CSFV.

The data produced in the project has shown the CSF vaccines are not effective in the control of CSFV in farms around HCMC. DAH and NAVETCO has data that shows farms can achieve good antibody levels on farms from vaccination if the correct CSF vaccine and vaccination protocol are used. This information was made possible by CSF diagnostics

AAHL the lead Australia organisation managed project, providing necessary equipment, reagents and laboratory ware and training required to allow the completion of the project and outcomes listed above. AAHL kept the project on target and has supported all requests from the Vietnamese partners. Training was carried out in Australia and Vietnam with both partners benefiting from the information that is being generated.

Implementation of the project in Vietnam by NAVETCO, the lead Vietnamese organisation, was managed well. Trainees were supplied in a timely manner, from NAVETCO and DAH. NAVETCO and DAH supplied equipment and upgrades to their laboratories to take full advantage of the new technologies. The field work was organised well, with data being collected from farms using different vaccines and vaccine protocols, highlighting the issues with the CSFV vaccines.

1. Project Description

1.1 Background and preparation

CSF is a disease of major concern in Vietnam causing large losses to pig farmers, both commercial and smallholder. Vietnam produces a vaccine for CSF at NAVETCO, but there are concerns regarding its effectiveness. NAVETCO had been assigned by MARD to study CSF (also known as hog cholera) to improve national diagnostic capability and to develop a vaccine based on cell culture techniques. CSF is known internationally as one of the most serious diseases of pigs. Depending on the strain of virus, infection may result in mortalities of up to 100%. In countries where the virus has not been eradicated, the disease is controlled by vaccination. The economic cost of CSF to Vietnam would be difficult to quantitate without an accurate diagnostic capability, but the assessment by DAH and MARD that it is the most serious problem facing the pig industry can be accepted.

Improved control of CSF will deliver financial benefits directly to both large and small farmers, and be economically beneficial to the country. Project inputs will be mainly in the area of animal health, improving veterinary science capability and taking the work the extra step to ensure that the benefits of the increased capability can be utilized. The project will result in a lasting increase in the capability of NAVETCO for research and development in vaccine development, testing, field evaluation and use. The importance of assisting farmers to derive benefit from the product will be emphasized.

1.2 Context and rationale

AAHL is Australia's national laboratory for the diagnosis of animal diseases exotic to Australia. It is involved in the development, management and application of tests for a large range of animal disease agents using a variety of traditional and advanced technologies. It is frequently involved in collaborative projects in Southeast Asian countries where expertise on disease diagnosis and related veterinary matters is needed.

AAHL has developed CSF tests for the detection of both CSF virus and antibodies to the virus, and maintains a cell culture laboratory as well as expertise in the molecular analysis of virus isolates. AAHL is active in the area of developing and testing vaccines for CSF.

AAHL had recently completed a major project for ACIAR, on duck virus enteritis (DVE or duck plague). ACIAR project reviews indicated it was considered a very successful project. New diagnostic tests for DVE were developed and transferred to NAVETCO, extensive training for Vietnamese veterinarians was delivered and a new vaccine was developed and evaluated.

The National Veterinary Company (NAVETCO) is an agency within the Ministry of Agriculture and Rural Development of Viet Nam. NAVETCO produces vaccines for many animal and poultry diseases and has a Research section which studies disease, introduces new diagnostic techniques and develops new vaccines. The research section is also involved in training scientists from other institutes and students from universities.

A close relationship has developed between AAHL and NAVETCO due to the successful project in DVE, which helped produce a new DVE vaccine which is cheaper to produce

and cheaper for the farmer. NAVETCO looks to AAHL for advice and reagents for veterinary diagnostic tests, and was keen to have the relationship develop further under a formally funded project.

CSF was chosen as the disease was of major economic importance to Vietnam and allowed AAHL to continue to strengthen NAVETCO diagnostic and cell culture capabilities.

1.3 Project objectives and scope at design

The project will address the control of classical swine fever (CSF) disease in Vietnam, transferring diagnostic techniques and providing training in a number of areas. An improved cell culture capability will be established at NAVETCO to support diagnosis and the development of improved vaccine production. Molecular analyses will identify strain differences among CSF virus isolates. Protection trials with current vaccines will be conducted under controlled conditions in pigs to determine if virus diversity of field strains is a reason for vaccine failure. Diagnostic techniques established at NAVETCO will be transferred to other Vietnamese veterinary laboratories, and training of field veterinarians in the diagnosis of CSF and sample collection will be conducted. Field trials of vaccination techniques and any new vaccine developed by NAVETCO will be conducted. Farmer education programs will be developed to communicate vaccination and other control strategies.

1.4 Implementation arrangements

AAHL the lead Australia organisation managed the delivery of technology transfer and training. AAHL kept the project on target and supported all requests from the Vietnamese partners. NAVETCO the lead Vietnamese organisation managed the implementation of the project in Vietnam. NAVETCO reported on the progress of laboratory and on-farm activities in Vietnam. Trainees were supplied in a timely manner, from NAVETCO and DAH. NAVETCO and DAH supplied equipment and upgrades to their laboratories to take full advantage of the new technologies. DAH provided field network to access CSF isolates from the field.

2. Appropriateness of Project Design and Objectives

2.1 Appropriateness of Objectives

Objective No	Objective description	Appropriateness Rating
1	Establish an enhanced cell culture capability in the NAVETCO laboratories.	5: Best Practice
2	Transfer CSF diagnostic capability from AAHL to NAVETCO, including cell culture based techniques of virus isolation and serum neutralization tests (NPLA) for the detection of antibody, as well as immunoassay techniques such as antigen and antibody detection ELISA. Transfer ELISA technology from NAVETCO to DAH laboratories as requested by DAH.	5: Best Practice

3	Using cell culture at NAVETCO, make a collection of isolates of CSF viruses from cases of CSF disease on farms. At NAVETCO and AAHL use molecular techniques to assess strain variation. Select a subset of isolates for further study.	5: Best Practice
4	Refurbish facilities for animal experimentation at NAVETCO if necessary. Develop a standardized challenge model for experimental production of CSF in pigs. Test the subset of isolates for virulence, and test the efficacy of the NAVETCO CSF vaccine in protecting against challenge.	4: Fully Satisfactory
5	Train NAVETCO and DAH staff in outbreak investigation for the investigation of cases of CSF on farms, including sampling strategies and data collection. Develop a register of apparent and proven cases of vaccine failure, and develop strategies to analyse causes.	5: Best Practice
6	NAVETCO will use the new cell culture capability to produce an experimental cell culture based CSF vaccine, with the objective of replacing existing products. The challenge model developed above will be used in efficacy studies.	5: Best Practice
7	Train NAVETCO in conduct of field trials of CSF vaccines, to identify appropriate products and procedures for their use under both large and small scale farming conditions.	5: Best Practice
8	Develop pig health care information and training packages for large and small scale pig farmers and their veterinary advisors, with emphasis on CSF prevention and prevention of other infectious diseases.	5: Best Practice

2.2 Appropriateness of Design

Description of design feature	Appropriateness Rating
The key design feature of this project is an approach to laboratory technology transfer based on reciprocal staff visits, firstly by the Vietnamese to learn the techniques in an environment where the technology is established to international best practice, followed by an opportunity for the Vietnamese to initiate the technology in the home laboratory prior to AAHL staff visits to assist in auditing, trouble shooting and application of the technology to Vietnamese problems.	5: Best Practice;
In the purchase of equipment, every effort has been made to encourage the Vietnamese partners to identify a supplier of the item in Vietnam, with the intention to make the purchase in country if possible, at a reasonable price. This approach ensures the user is actively involved in the process, is familiar with the equipment on offer and the features of any competing brands, and where equipment is purchased in country the user has the opportunity to negotiate service agreements. The drawback	5: Best Practice;

is that purchasing process can become protracted, and there is a risk, if not managed closely, that inferior equipment may be bought.	
Technology transfer will be supported by instruction in its application to in-country situations through co-design of research that is supported by the transferred technology, and further dissemination through a workshop conducted in the Vietnamese participating laboratory. This gives Vietnamese collaborators the opportunity for mentoring in research by AAHL scientists, and the opportunity for their laboratory to establish a reputation in Vietnam as a centre for such activities.	5: Best Practice;

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	Establish an enhanced cell culture capability in the NAVETCO laboratories.	NAVETCO have an enhanced cell culture capability in there laboratories.	Cell culture has been used for serology and virus isolation	5: Exceeding time and quality targets,
2	Transfer CSF diagnostic capability from AAHL to NAVETCO, including cell culture based techniques of virus isolation and serum neutralization tests (NPLA) for the detection of antibody, as well as immunoassay techniques such as antigen and antibody detection ELISA. Transfer ELISA technology from NAVETCO to DAH laboratories as requested by DAH.	NAVETCO has a diagnostic capability for CSF diagnosis established in it laboratory.	Diagnostic tests for serology and antigen detection in use at NAVETCO. Data produced to show CSF vaccines are not effective.	5: Exceeding time and quality targets,
3	Using cell culture at NAVETCO, make a	CSF isolates collected. Sequence analysis	CSF isolations. Sequence data and virulence	4: Achieving

	collection of isolates of CSF viruses from cases of CSF disease on farms. At NAVETCO and AAHL use molecular techniques to assess strain variation. Select a subset of isolates for further study.	carried out on CSF isolates. Virulence studies carried out on CSF isolates chosen for further study.	studies show current isolates of CSF vary to NAVETCO challenge strain. <i>Further training is necessary for both AAHL and Vietnamese scientists to take advantage of the information that is being produced.</i>	time and quality targets and on budget;
4	Refurbish facilities for animal experimentation at NAVETCO if necessary. Develop a standardized challenge model for experimental production of CSF in pigs. Test the subset of isolates for virulence, and test the efficacy of the NAVETCO CSF vaccine in protecting against challenge.	Refurbishment facilities for animal experimentation at NAVETCO. Develop a standardized challenge model for experimental production of CSF in pigs. Test the subset of isolates for virulence, and test the efficacy of the NAVETCO CSF vaccine in protecting against challenge.	Laboratory trials carried out with CSF isolates. Standardized challenge model developed.	4: Achieving time and quality targets and on budget;
5	Train NAVETCO and DAH staff in outbreak investigation for the investigation of cases of CSF on farms, including sampling strategies and data collection. Develop a register of apparent and proven cases of vaccine failure, and develop strategies to analyse causes.	Train NAVETCO and DAH staff in outbreak investigation for the investigation of cases of CSF on farms, including sampling strategies and data collection. Develop a register of apparent and proven cases of vaccine failure, and develop strategies to analyse causes.	Workshop held at NAVETCO to train NAVETCO and DAH staff in disease investigation and diagnostics. Vaccine failures were identified.	4: Achieving time and quality targets and on budget;
6	NAVETCO will use the new cell culture capability to produce an experimental cell culture based CSF vaccine, with the	NAVETCO will use the new cell culture capability to produce an experimental cell culture based CSF vaccine, with the	New CSF vaccine from AAHL tested at NAVETCO. CSF rabbit vaccine has been passaged in cell culture. Development of new	4: Achieving time and quality targets and on budget;

	objective of replacing existing products. The challenge model developed above will be used in efficacy studies.	objective of replacing existing products. The challenge model developed above will be used in efficacy studies.	vaccine to continue after project has been completed. (DVE vaccine produced in ACIAR project has taken four years to be completed) All is going well in this project.	
7	Train NAVETCO in conduct of field trials of CSF vaccines, to identify appropriate products and procedures for their use under both large and small scale farming conditions.	Train NAVETCO in conduct of field trials of CSF vaccines, to identify appropriate products and procedures for their use under both large and small scale farming conditions.	<i>Training has been delivered. A number of field trials have conducted looking at the current CSF vaccines by both NAVETCO and DAH. Studies have been carried out looking at 5 farms using different vaccine protocols. Vaccine challenge trial and has been carried out with old vaccine. The data collected from serology surveys in the field and from laboratory studies have shown that CSF vaccines and vaccine protocols are not providing protection against CSF disease outbreaks.</i>	4: Achieving time and quality targets and on budget;
8	Develop pig health care information and training packages for large and small scale pig farmers and their veterinary advisors, with emphasis on CSF prevention and prevention of other infectious diseases.	Develop pig health care information and training packages for large and small scale pig farmers and their veterinary advisors, with emphasis on CSF prevention and prevention of other infectious diseases.	Workshop on CSF diagnostics. As part of this workshop pig health and CSF control was discussed. Data collected in the project presented at workshop to show CSF vaccines are not effective.	4: Achieving time and quality targets and on budget;

5: Exceeding time and quality targets, 4: Achieving time and quality targets and on budget; 3: Moderate progress towards targets, some issues about quality, budgets or costs but these are being adequately addressed; 2: Some progress towards targets, but slippage in schedule and cost overruns; & 1: Significant problems in achieving targets, quality outputs unlikely to be achieved and substantial cost increases affecting overall budget.

3.2 Project Outcomes

The project has achieved its major objectives, the transfer and of CSF diagnostic technologies to NAVETCO and their establishment at NAVETCO, an enhanced cell culture capability at NAVETCO, ELISA technologies to DAH, collection and analysis of CSF isolates, establishment of a challenge model for CSF, training of DAH and NAVETCO staff in disease investigation, CSF control, farm biosecurity and pig health and a preliminary survey of the effectiveness of CSF vaccines used around HCMC.

NAVETCO scientists received training at AAHL and NAVETCO in ELISA technologies, molecular techniques, histology and immunohistochemistry, tissue culture techniques, including those for virus isolation and serology and laboratory quality assurance. DAH scientists received training in ELISA technologies and an introduction to cell culture and molecular techniques.

NAVETCO has carried out studies on maternal antibody levels in piglets on farms and in the laboratory to determine if CSF vaccines are being used at the correct time. This data has shown that CSF vaccines are not effective, and this able to be determined using the CSF diagnostics transferred to NAVETCO. NAVETCO as carried out detailed challenge experiments to show the correct time to vaccinate pigs. In all NAVETCO has tested more than 5000 sera and carried out 6 major experiments looking at CSF antibody in pigs. DAH and NAVETCO have collected more than 400 field samples from suspect CSFV outbreaks, 200 of these samples were compared in the ELISA and virus isolation tests. 15 CSF isolates were sequenced and 6 of these were used in virulence studies.

Adapting CSF vaccine produced in rabbits to cell culture has been more difficult than expected. We have contacted scientists in Thailand who have succeeded in adapting CSF vaccine to cell culture, and they are providing advice to NAVETCO. The production of a cell culture vaccine is important and the aim of this project was to train NAVETCO staff in the production of CSF vaccine in cell and to start the adaptation of CSF vaccine to cell culture. This work is continuing.

A pilot CARD project with NAVETCO\AAHL, has shown that vaccination regimes used on farms near HCMC do not provide the required level of protection against CSF. Before this study there were no data available on the effectiveness on CSF vaccines. Transferring diagnostic capability for CSF from AAHL to NAVETCO has enabled this. The findings from the CARD project were presented at the National and Regional CSFV meeting in Hanoi, where the importance of controlling CSF and the need to set up a standard approach to vaccination and for the provision of an effective diagnostic network in Vietnam was reaffirmed.

This project has therefore been a great success in achieving its objectives and supplying valuable information to DAH, MARD and the Vietnamese government that can be used in the control of CSF. The project has achieved its purpose and identified the need for further work with CSF in the whole of Vietnam and the need to establish CSF diagnostics in regional laboratory to allow further epidemiological studies into CSF and CSF vaccines.

3.3 Sectoral Impact

Since NAVETCO supplies vaccine throughout Vietnam, all pig producers are potential beneficiaries. Those that take up the advice and use vaccine according to recommendations will benefit financially through reduced losses due to death and disease in their pigs. The benefits of a more profitable farming operation flow to all family members. The CSF vaccine produced by NAVETCO is cheap enough to allow it to be supplied to minority communities and other disadvantaged groups. The diagnostic capability allows NAVETCO to show the effectiveness of their vaccine and to ensure it is used correctly, allowing all to benefit.

Professional veterinarians in Vietnam seem to be a good mix of men and women. This includes women in senior managerial positions in the laboratories. There is a good gender balance among the scientific and technical staff in the laboratories. It will be requested that groups that come to AAHL for training should give consideration to this aspect. Since women at the village level are the primary animal handlers and managers, they will indirectly be major beneficiaries of the final outcome of better diagnosis and control of animal diseases.

3.4 Costs and Financing

Training was delayed in first year of project due to timing of trainees coming to AAHL which has been caught up in the second year of the project. This has meant less money spend in the first year of the project. Shipping of biologicals by plane became more difficult during the project with the cost increasing significantly during the project, as a reaction to terrorism. Liquid Nitrogen Tanks (2 units) were purchased by NAVETCO and the project purchased pipettes needed for serology instead of the tanks. Diagnostic reagents were also an increased cost, especially the cost of FCS, which more than doubled in price during the project. Some prices differences for equipment, some equipment slightly dearer and some cheaper. Extra equipment was purchased by all partner laboratories to make full use of the data being collected from the field and laboratory work.

3.5 Monitoring of project

AAHL had overall responsibility for project deadlines, with NAVETCO responsible for the day to day running of the project. Contact through training at AAHL and NAVETCO meant the project staff were in face to face contact as well as email or phone contact. This arrangement worked well for this project as NAVETCO and AAHL had a good working relationship. Monitoring of DAH also worked well as both AAHL and NAVETCO were contact points for DAH staff. Combining experienced and inexperienced Vietnamese partners to expand training and knowledge is the best approach to new projects with new partners.

3.6 Technical Assistance, Training and Capacity Building

AAHL had recently completed a major project for ACIAR, on duck virus enteritis (DVE or duck plague). ACIAR project reviews indicated it was considered a very successful project. New diagnostic tests for DVE were developed and transferred to NAVETCO,

extensive training for Vietnamese veterinarians was delivered and a new vaccine was developed and evaluated.

The National Veterinary Company (NAVETCO) is an agency within the Ministry of Agriculture and Rural Development of Viet Nam. NAVETCO produces vaccines for many animal and poultry diseases and has a Research section which studies disease, introduces new diagnostic techniques and develops new vaccines. The research section is also involved in training scientists from other institutes and students from universities.

A close relationship has developed between AAHL and NAVETCO due to the successful project in DVE, which helped produce a new DVE vaccine which is cheaper to produce and cheaper for the farmer. NAVETCO's and AAHL's relationship has continued to develop further under the CSF project. The results in this project have again allowed the 2 laboratories to show the benefits of an established diagnostic capability to control disease.

Training workshops allows the knowledge to be spread to a wider group and that combined with the data from this project allows these laboratories to show the Vietnamese the importance of them having a similar capability.

During this project NAVETCO has taken on 7 students for training in new techniques. Also 12 scientists at NAVETCO and 1 scientist at DAH are using this project to gain masters qualification.

This project has seen DAH and NAVETCO work together and these 2 organisations now have a much closer working relationship, which will benefit all stakeholders.

3.7 Management of Constraints, Issues, Risks and Change

The field trials and animal experiments were labour intensive and to complete these experiments it was necessary to extend the project. eg Field experiment where 38 sows and their litters (370 piglets) were bleed weekly for 6 weeks. Often the same staff due for training AAHL were doing the field trials, which meant the training time table was delayed to suit. Critical training to allow project to continue, were never delayed. eg molecular training was delayed. It was not possible to sequence all the CSF isolates, so a subset (15) was chosen. Adapting CSF vaccine produced in rabbits to cell culture has been more difficult than expected. We have contacted scientists in Thailand who have succeeded in adapting CSF vaccine to cell culture, and they are providing advice to NAVETCO. Reagent supply is a constraint to CSF diagnosis; AAHL is looking at supplying reagents to NAVETCO at a cheaper price to allow the volume of testing to continue.

3.8 Project Management

Implementation of the project is on schedule. AAHL has kept the project on target and has supported all requests from the Vietnamese partners. Training has been carried out in Australia and Vietnam with both partners benefiting from the information that is being generated.

Implementation of the project in Vietnam by NAVETCO also went well. Trainees have been supplied in a timely manner, from NAVETCO and DAH. DAH and NAVETCO

continue to supply equipment and to upgrade their laboratories. The field work continues to be organised well with data being collected from farms using different vaccines and vaccine protocols, highlighting the issues with CSFV vaccines.

Rating: 5: Best Practice/4: Fully Satisfactory.

5: Best Practice; 4: Fully Satisfactory; 3: Satisfactory Overall; 2: Marginally Satisfactory; 1: Weak.

4. Performance and Outcomes

4.1 Assessment of Performance Against Objectives and Design

AAHL and NAVETCO have performed well in achieving all the objectives in the projects with only a delay in the production of a CSF cell culture vaccine which was anticipated. The production of a cell culture CSF vaccine is continuing and AAHL will continue to advise NAVETCO in this work. Further work could be carried out in the analysis of CSF isolates with further sequencing but planned work was achieved. The project has achieved a large workload with the major outcome of the project the establishment of CSF diagnostics at NAVETCO and the data from the project showing CSF vaccine are not effective. This information and knowledge has been passed on to all stakeholders through the CSF workshop and the regional CSF meeting in Hanoi. It was agreed that it was important to establish vaccine protocols for the use of CSF vaccines and that CSF diagnostic capability in regional laboratories is a priority.

4.2 Sustainability

AAHL is confident that most of the activities initiated under this project will be sustainable. We note the following points.

- NAVETCO appears to be well supported by the central government. Over the years we have been involved with the Institute there has been a steady program of capital expenditure resulting in improved laboratory facilities. The DAH laboratory is also receiving increased support from central government and has improved laboratory facilities.
- NAVETCO is developing in confidence as an institution. Whereas a few years ago collaboration with DAH was not encouraged (perhaps for fear of dilution of the inputs to NAVETCO?), under this project collaboration is open and encouraged. The collaboration between NAVETCO and DAH laboratories is expanding to other laboratories in South and Central Vietnam.
- The NAVETCO scientific staff are quick to understand new information and are energetic in its implementation. People have an obvious desire to do their jobs well. This desire is obvious in staff in DAH and other laboratories. The laboratories just need technical support to be encouraged to carry out the techniques that they need for diagnosis and research.
- The project is following a well tried model for successful technology transfer, of demonstration and teaching of the technology in the donor facility followed by supply of reagents for implementation by the trainees at their own initiative in the

recipient laboratory, subsequently backed up by consultancy visits to the recipient laboratory for support and fine tuning. A useful indicator of likely success is the initiative and ability of the trainees to make a useful attempt at implementation by themselves. NAVETCO and DAH staff show a high level of involvement in this way.

- The ACIAR funded Duck Plague DVE project that linked NAVETCO and AAHL prior to this project, is proving sustainable. NAVETCO not only maintains the diagnostic capability developed at that time, but on its own initiative and unassisted by AAHL is conducting training courses and technology transfer to other labs in Viet Nam. The new cell culture base vaccine for DVE is being sold by NAVETCO to Cambodia as well as being used in country.

4: Fully Satisfactory;

5: Best Practice; 4: Fully Satisfactory; 3: Satisfactory Overall; 2: Marginally Satisfactory; 1: Weak.

4.3 Development Impact

The project has had an immediate impact in highlighting to DAH, MARD and the Vietnamese government that CSFV vaccines are not been used correctly and that CSF diagnostics are important in the control of CSF. In the next 3 years the technologies transfer to NAVETCO will help improve the use of vaccine from NAVETCO. It is important that the work in this project is followed up to maximise the benefit of the information from this project. AAHL, NAVETCO and DAH have identified that it is important to train regional laboratories in CSF diagnostics to allow data to be collected from the whole of Vietnam which will show the CSF situation in the whole country. This will set up a diagnostic network for the whole of Vietnam to control CSF and provide major benefits to farmers, especially poor farms who normally can't afford to test their pigs. The information will show the Vietnamese government the importance of diagnostics combined with disease investigation in the field. This support will allow sustained diagnosis for the long term.

5. Conclusions

5.1 Overall assessment

The project has achieved all its major objectives, the transfer and of CSF diagnostic technologies to NAVETCO and their establishment at NAVETCO, an enhanced cell culture capability at NAVETCO, ELISA technologies to DAH, collection and analysis of CSF isolates, establishment of a challenge model for CSF, training of DAH and NAVETCO staff in disease investigation, CSF control, farm biosecurity and pig health and a preliminary survey of the effectiveness of CSF vaccines used around HCMC. The project has given the NAVETCO the diagnostic capability to improve CSF control in Vietnam and to improve its vaccine production The project has also helped NAVETCO and DAH have a closer working relationship which will ultimately help farmers.

The project had a heavy workload which was achieved by the partner laboratories giving data to DAH and MARD showing the importance of CSF diagnostics to the control of

CSF. The project has not completed the production of a new CSF vaccine in cell culture, this was unrealistic in the 2 years of the project but knowledge and training has been put in place to achieve this objective (DVE cell culture vaccine took 4 years and this vaccine grows well in cell culture unlike CSF). This project has shown the importance of CARD funding to improving animal health in Vietnam which will lead to less poverty.

5.2 Lessons Learned

This pilot project has achieved a lot in a short amount of time. The establishment of CSF diagnostics at NAVETCO has been a great achievement. The information collected in the project has highlighted to DAH, MARD and the Vietnamese government the need to have a diagnostic capability to control disease and understand the causes of disease outbreaks on farms. The application of vaccines alone without diagnostic support will not control disease outbreaks. To maintain a diagnostic capability in laboratories there is a need for quality assurance programs in the laboratories to protect the investment made by the stakeholders. There is a need for external quality assurance programs similar to the ANQAP program in Australia to ensure diagnostic tests are maintained and giving the correct results.