AANZFTA Economic Cooperation Work Programme

ASEAN Diagnosticians Forum

Putrajaya Marriott Hotel, Malaysia

15–16 December 2015

Summary of Outcomes

1. **What have been the benefits of the ASEAN Regional Diagnostic Network Project for the countries represented in the discussion group?**

   Forum participants perceived that the benefits and strengths of the ARDN Project included the following:

   a. The regional nature of the Project has enabled benefits to flow to all ASEAN Member Counties.
   b. Activities have enhanced skills of front-line diagnosticians, promoting their confidence in the diagnostics of particular pest and diseases and developing a regional cadre of "parataxonomists".
   c. Most activities have promoted networking among ASEAN diagnosticians. Some have promoted in-country networking and some have enabled two-way exchange of information between trainees and expert trainers.
   d. In-country mentoring activities have been especially effective in several countries. In-country activities which have incorporated experience in the field with farmers and briefing of regional plant protection staff have been especially beneficial.
   e. Some activities have produced or are producing diagnostic resources tailored to needs in the ASEAN region (e.g. a key to important pest nematodes).
   f. Several activities have incidentally stimulated the publication of technical information or analyses that are of wide applicability (e.g. analysis of risk pathways for pest nematodes, extraction techniques for nematodes, reports on new detections of pest scale insects).
   g. The Project has promoted the use of new, diagnostic technologies, including molecular methods (especially for viral, bacterial and fungal diseases) and remote microscopy (especially for insect pests). New understanding of how molecular diagnostics can be utilised in the absence of sophisticated molecular laboratory facilities has been particularly revealing for participants in the Project's mycological activities.
   h. Project activities have promoted informed awareness among ASEAN diagnosticians of emerging, global, phytosanitary risks.
   i. A number of Project activities (e.g. workshops focusing on molecular methods, whiteflies and immature Lepidoptera) have made use of high quality, laboratory, teaching facilities within the ASEAN region. Wider awareness of these training venues and appreciation of what will be required for future training has been a useful outcome of the Project.

j. The Project has also promoted better understanding within at least some National Plant Protection Organisations (NPPOs) of the nexus between pest and disease diagnostics, biosecurity and trade.

What have been the shortcomings of the Project?

Forum participants identified the following shortcomings of the ARDN Project:

a. Training was challenged by the different levels of expertise, basic knowledge and infrastructure among the ASEAN Member Countries. While some activities were successfully promoted as "advanced" training and ultimately involved only trainees with appropriate skills and access to essential facilities, training delivered at the "front line"/novice level often included individuals with minimal basic knowledge of pests, methods and equipment.
b. Because of the limited numbers of experienced trainers, it has not been feasible to offer in-country mentoring and other follow-up activities to all countries which have participated in training workshops.
c. Some topics addressed by short-duration workshops were too broad for the time available.
d. There are few, regionally validated diagnostic protocols and keys, upon which training can be based.
e. There has been limited focus on upgrading reference specimens and samples of pests and diseases of importance to quarantine and market access. These specimens and samples commonly are required as "positive controls".
f. Communication barriers are an inevitable challenge, especially where trainers are unfamiliar with ASEAN languages and styles of communication.
g. Commonly, different members of diagnostic teams took part in different training activities. While this provided international experience to a larger number of people, some continuity was lost.
h. Some participants in the Forum felt that the "right" people had not always been chosen for training.
i. Because of internal staff transfers in some organisations, some trainees who were "right" at the time, now have responsibilities which do not include the technical area in which they received training. This makes it challenging to maintain the currency of a database of regional, diagnostic expertise.
j. The Project assisted several trainees to enter into long-term attachments, but did not provide funding for this.
k. The Project has assisted the development of taxonomic skills but has not "created" any genuine, new, ASEAN-based taxonomists.
l. Participation in Project activities was not proscribed but in practice largely has included only officers from NPPOs. In many cases this reflects the fact that interest in the training topics has resided principally in NPPOs. However, some topics were of genuine interest to universities and research organisations and, unfortunately, participation by these institutions was not possible because of the limited number of places available in training events. The result has been only modest participation in the Project by universities and research organisations.
m. The Project has not emphasised providing specialised equipment or facilities for diagnostics or maintaining reference material. Maintaining samples and reference material (e.g. culture collections, insect collections) is problematic for many ASEAN diagnostic laboratories.
n. The Project has not included activities to integrate information residing in reference collections into national databases.

o. Apart from activities which have been undertaken over several years, the Project has not actively and systematically monitored the performance of individuals who have participated in training or the impact of training on diagnostic laboratories.

2. What criteria should be used to select pests, diseases or weeds for future capacity building?

The Forum endorsed criteria currently used in the ARDN Project to select groups of pests, diseases and weeds for capacity building activities. The criteria are not mutually exclusive and taxa are not expected to satisfy all criteria:

a. taxa having significant, adverse impacts on horticulture, field crops, the environment, forest production or plantation crops, including newly emerging or "outbreak" pests, diseases and weeds;
b. taxa associated with important regional crops (e.g. rice, rubber);
c. taxa potentially associated with exported or imported goods (especially agricultural commodities);
d. taxa present in at least part of the ASEAN region, and a potential constraint to trade involving ASEAN countries;
e. taxa not present in the ASEAN region but a quarantine threat to ASEAN Member Countries;
f. taxa occurring on official lists of regulated or quarantine pests for ASEAN Member Countries;
g. taxa which are difficult to diagnose;
h. taxa which are priorities for multiple countries (but not excluding species which currently may be of concern to only one country but which may represent an emerging threat to a wider group of countries);
i. taxa for which expertise in the ASEAN region is lacking;
j. topics for which expert trainers and training facilities are available;
k. taxa or topics for which sound, scientific resources are available;
l. activities which promote development of professional or technical skills; and
m. activities which promote networking of expertise within AANZFTA countries.

Three additional criteria were suggested, of which the last falls out of scope for the ARDN Project which focuses on plant pests:

n. species with potential to adversely affect the environment;
o. biological control agents and other beneficial organisms; and
p. species with potential to adversely affect human or animal health.

What pests, diseases or weeds are important to the countries represented in the discussion group?

Bearing in mind the preceding criteria, the Forum regarded the following groups as high priorities for diagnostic capacity building. Some groups of pests listed below have already been the focus of ARDN Project activities, but some participants in the Forum were of the view that additional attention to these areas is warranted. The list was developed with the understanding that it is preliminary list only and that additional, thorough consultation with ASEAN NPPOs would be necessary to finalise priorities for future capacity building.

a. Plant viruses
    i. General virus diagnostics
    ii. Tospoviruses
    iii. Begomoviruses

iv. Seed-borne viruses
v. Papaya ring spot virus.

b. Viroids
   i. Potato spindle tuber viroid.

c. Phytoplasmas
   i. Phytoplasmas affecting cassava.

d. Bacteria
   i. *Pseudomonas* (including *Pseudomonas* associated with cucumber)
   ii. *Xylella fastidiosa*
   iii. *Clavibacter*
   iv. *Erwinia*
   v. *Elsinoe fawcetti* (citrus scab)
   vi. Citrus canker (*Xanthomonas axonopodis*)
   vii. Bacterial diseases of banana (Moko - *Ralstonia solanacearum*; blood disease).

e. Fungi
   i. Damping off fungi
   ii. Seed-borne fungi
   iii. Black rot of grapes
   iv. Flower blight of Camellia
   v. Ascomycetes
   vi. Basidiomycetes
   vii. Rusts
   viii. Cercosporoids
   ix. South American leaf blight
   x. Unculturable fungi
   xi. *Fusarium*, including Fusarium oxysporum f.sp. *cubensis* (Panama disease)
   xii. *Phythophthora*.

f. Nematodes
   i. Tylenchidae
   ii. Aphelenchidae
   iii. Nematodes affecting root crops, rice, vegetables.

g. Arthropods
   i. Grasshoppers, yellow spined bamboo locust
   ii. Thrips
   iii. Scale insects, mealybugs
   iv. Aphids
   v. Families of Coleoptera
   vi. Pictorial keys to pests within
      a. "Homoptera" (Hemiptera), including leaf hoppers associated with rice
      b. Coleoptera
      c. Diptera
      d. Lepidoptera
   vii. Leaf miners
   viii. Cecidomyiid flies
   ix. Weevils associated with mango fruit and palms: red palm weevil, mango seed weevil, mango pulp weevil
   x. Stored product arthropods, including *Tribolium*, *Sitophilus*
   xi. Tephritidae (especially *dorsalis* group, *cucurbitae*, *latifrons*, *umbrosa*).

h. Vascular plants
    i. Weed seeds.

3. What are the requirements for developing capacity in taxonomic and diagnostic methods (e.g. molecular methods, digital imaging)? Try to be specific about the level of skills required in each method.

The following were highlighted as important techniques, technologies or generic resources which could be targeted by future, diagnostic capacity building:

a. Light microscopy, including skills in the use of compound microscopes and dissection skills using stereo microscopes; upgrading of existing equipment through procurement of high-resolution objectives and eyepieces.
b. Digital imaging systems, including procurement of high-resolution compact cameras for macrophotography.
c. Smart software to assist with diagnostics, such as *Lucid* software for developing keys, *Genious* software for analysing molecular sequence data.
d. Development of on-line identification tools, including image libraries and pictorial guides.
e. Slide making capabilities, including provision of consumables required for making permanent slide mounts.
f. Technical competence in commissioning, using and maintaining complex, laboratory equipment, such the Biolog Microbial Identification System (for bacteria), PCR thermocyclers.
g. Access to specialist literature.
h. Availability of authoritatively identified, reference specimens and samples.

4. What is the role of universities and research organisations in the ASEAN Member Countries in developing diagnostic capacity?

Universities in ASEAN Member Countries have a critical role in training extension officers, researchers and scientists. To achieve this, universities require relevant, modern curricula for undergraduate and master's-level studies. With regard to diagnostics, these curricula should include taxonomy subjects which provide basic understanding of plant pest and disease diversity and biology, the significance of molecular diversity, and practical training in:

a. collection and processing of specimens and samples;
b. light microscopy;
c. high-level identification of pests and diseases (e.g. so that most insects can be identified to order or major families); and
d. recognition of the most commonly encountered species of plant pests and diseases.

These curricula also need to develop awareness of the relevance of diagnostics to pest management, plant protection and trade. Lecturers can perform a valuable role as long-term mentors to young plant health professionals, including diagnosticians. In the future, some universities may be well placed to offer short-term, specialist, capacity building activities on the diagnostic topics for which the university has particular expertise (e.g. bioinformatics, key building, or identification of pest Lepidoptera or Coleoptera). Currently, only a few ASEAN universities offer modern, supervision of taxonomic studies to PhD-level. ASEAN-based academics lecturers need to be aware of these universities and of teaching institutions outside the region which can further the development of students who demonstrate aptitude for taxonomy into the next generation of professional taxonomists and diagnosticians.

Well-equipped, teaching laboratories in universities can be venues for short-term, specialised, capacity building activities in diagnostics (as was demonstrated by the ARDN Project workshops on culturable ascomycete fungi, held at Mae Fah Luang and Chiang Mai Universities). Specialist laboratories of research organisations also can be co-opted for this kind of training (e.g. the ARDN Project workshops on whiteflies and scale insects, at the Malaysian Agricultural Research and Development Institute [MARDI] and the Forest Research Institute of Malaysia [FRIM] respectively). The Applied Research Institute of Agricultural Quarantine (ARIAQ), Bekasi, West Java, Indonesia, has hosted ARDN Project workshops on DNA extraction techniques and the identification of immature Lepidoptera in dedicated, teaching laboratories and lecture rooms.

Universities and research organisations can be relatively flexible and adaptable, and, thus, well placed to respond to scientific innovation or changing needs. They can be proactive and influential in the field of diagnostics by exploring new topics or techniques, or developing ideas for undergraduate and post-graduate studies. Collaborative projects with NPPOs could focus on developing new diagnostic resources (e.g. keys or protocols relevant to the ASEAN region) or validating existing diagnostic resources in ASEAN situations. Scientists in universities and research organisations may have substantial freedom to engage with the international research community to develop diagnostic resources (e.g. globally or regionally validated keys to groups of pests; global image or DNA libraries; national, regional or global checklists). Experts in universities and research organisations can materially assist NPPOs by providing peer review of national pest lists and methodology underpinning these lists.

Universities and research organisations also share with NPPOs the opportunity to initiate or convene technical conferences. For any of this to happen effectively, it is incumbent upon NPPOs to communicate priorities to universities and research organisations and recognise the taxonomic or diagnostic expertise that exists in these institutions. For their part, and especially with regard to taxonomy and diagnostics, specialists in universities and research organisations should be aware of the possible implications of scientific publications or public assertions which have material impact on national pest status or on how trading partners assess pest status.

5. What are the advantages and disadvantages of the different kinds of capacity building provided by the ASEAN Regional Diagnostic Network Project (e.g. workshops of one week's duration compared to three-month attachments)?

Forum participants drew on their experience of capacity building projects in general and not just upon ARDN Project activities.

a. Typically, workshops allow training to focus on specific pests or pathogens or on particular groups of pests or pathogens, and, by involving multiple countries, are cost effective and promote networking. It is easier for trainers, trainees and training facilities to integrate short-duration workshops (e.g. activities occupying up to 1 week) into their work schedules. Workshops of longer duration (e.g. occupying 2–3 weeks) are more suitable where the training topic is large (such as when a large number of species need to be covered) or where diagnosis involves lengthy preparation procedures (e.g. as for bacteria and viruses). However, long-duration workshops require trainees to be away from their workplace for extended periods (which may not be practicable or be supported by management), require considerable resources (e.g. funding for trainee accommodation), tie up laboratory facilities for extended periods, and can be fatiguing for both trainees and trainers. Adequate reference material is essential to workshops of any duration. A series of short workshops on a topic or related topics can be an effective

training model. Well-prepared workshop manuals can be an invaluable resource back in the workplace. Workshops can be an excellent platform for future collaborations or more advanced training. Short workshops generally develop generalist rather than specialist skills.

b. The impact of workshops is improved if there are follow-up activities. Country visits by trainers can be highly effective, especially if these visits involve surveys, sampling and the development of local systems. The nematode workshops sponsored by the ARDN Project have been complemented by country-based surveys and laboratory work, short reciprocal visits, project work, translations and contributions by trainees themselves to other training activities. The ARDN Project's scale insect workshop was followed by country visits focusing on collecting samples and preparing slide mounts. The impact of workshops can be prolonged by the formation of some kind of information-sharing forum. Participants in the scale insect workshop formed an email group for sharing information and posting queries. Participants in the ARDN Project's whitefly workshop formed a Facebook page. The long-term durability of these informal networks probably depends on reasonably frequent contributions or queries from one or two, active participants and occasional responses from international experts. Several participants in the scale insect and whitefly workshops were encouraged to pursue post-graduate studies in these topics; at the completion of their studies, these individuals will have acquired high-level diagnostics skills. Participants in the ARDN Project ascomycete workshops are being invited to submit additional samples for sequencing. It is hoped that this will develop confidence in the process of obtaining molecular diagnostic data from their own workplaces. The ARDN Project will undertake formal monitoring of the outcomes of workshops, and it has been suggested that universities could assume a useful, semi-independent role in monitoring.

c. Long-term attachments (e.g. of one to several months) can be highly effective both for entry-level or "near-expert" trainees, but are costly, remove participants from the work place and family for extended periods, generally are accessible to only a very small number of trainees, and place a high premium on the selection of appropriate trainees. Long-term attachments are particular suitable for implementing collaborative projects, which can be the best vehicle for the transfer of high-level skills.

d. Remote training, especially using Nikon-based, remote microscopy has not yet been fully exploited by the ARDN Project or other capacity building initiatives. In principle, it is cost effective. However, several obstacles remain: it remains technically challenging for most organisations to set up two-way, remote microscopy sessions; lack of infrastructure (both Nikon equipment and internet access) is a problem at many sites; many trainees find it difficult to convey their questions or express their uncertainties to trainers during remote microscopy sessions, and trainers in turn find it difficult to respond (and these difficulties can be magnified by language barriers).

e. A regular, regional, cross-disciplinary, technical forum in which new, diagnostic resources and widely applicable, diagnostic methods could be showcased was considered to be a useful "complement" to the more familiar methods of capacity building. Most institutions would find it difficult to provide funding to enable even a subset of their diagnosticians to participate in such a Forum.

The Forum did not discuss formal training (e.g. BSc, MSc or PhD) or the provision of equipment or literature.

6. What needs to be done to make reference collections and databases more useful for performing diagnostics of plant pests, diseases and weeds in ASEAN member countries?

These resources are used principally for developing new diagnostic tools, assisting in the performance of diagnostics, and to substantiate plant health status.

Reference collections

Policy

a. The emergence and recognition of one collection as the national reference collection can provide leadership within a country, to improve policies and practice regarding all reference collections within the country. The same positive effect could be achieved by recognising a series of specialist, reference collections (e.g. arthropod reference collection, mycological reference collection), either on a national or regional scale.
b. Custodians of micro-organism, culture collections in ASEAN Member Countries, in particular, could take advantage of recognised, international collections as long term repositories, including repositories beyond the ASEAN region.
c. Material held in reference collections needs to be more accessible, with flexible, prudent, practical policies regarding sharing and lending of material. Material from which DNA can be extracted for diagnostic purposes is a particular priority.
d. Custodians of reference collections should assist operational, quarantine laboratories by helping these laboratories to develop, small reference collections, appropriate to operational needs and by providing training in the development and upkeep of these collections.
e. Greater awareness among research organisations and government agencies, of the need to deposit voucher material in reference collections, including vouchers associated with published accounts.
f. Greater awareness of among research and organisations and government agencies of priorities associated with quarantine market access.
g. Commitment to the long-term goal of national collections comprehensively representing the pest and disease status of a country, e.g. across regions and cropping systems. Acquisition of specimens or samples which might be confused with pest species also increases the utility of collections. Acquisition of authoritatively identified specimens or samples of quarantine importance also increases the usefulness of collections to diagnosticians.

Technical

a. Training in preservation, storage and maintenance of reference collections, including handling of culture material and material associated with DNA-based diagnostics. Wider adoption of international best practice in collection management, including through use of IPPC manuals.
b. Adoption of international standards for data associated with specimens, and digitisation of this data to enhance accessibility.
c. Appropriate storage facilities, including secure insect cabinets, freezers, driers, equipment, climate control (especially for management of humidity) and consumables.
d. Complement collections with digital image libraries, especially for organisms which are difficult to preserve (e.g. nematodes).

Verification of identifications in collections

a. Commitment to on-going validation and updating of identifications and nomenclature by utilising:

i. National resources (e.g. specialists in research organisations, universities).
ii. International expertise (e.g. by remote microscopy, by sending specimens abroad, by inviting specialists to re-organise collections and provide training).

Databases

a. Training in development and management of institutional databases, including adoption of international standards, appropriate data base formats, and best practice in managing data quality.
b. More digitisation of records.
c. Linking of databases within countries and across region, with appropriate management of access and confidentiality (e.g. by password protection).

7. What are the characteristics of a reliable diagnostician and a reliable diagnostic laboratory?

Generalist diagnostician

a. Capable of recognising symptoms, causal agents.
b. Basic, broad level of knowledge of diagnostics. Basic skills in in sampling, specimen preparation (e.g. slide making, isolation).
c. Capable of processing samples quickly.
d. Capacity to identify varies from group to group (e.g. able to identify to family level in many groups, but to species in only a few groups). Limited capacity to confidently identify detections outside normal range of experience.
e. Capacity often context or discipline specific (e.g. “quarantine interceptions”, “forest insects”).
f. Has access to appropriate laboratory facilities (e.g. microscopes, imaging facilities) and technical literature relevant to day-to-day work, image libraries etc.
g. Provides identifications, advice, reports and occasional technical publications.
h. Has participated in some sort of training, proficiency testing.
i. Has direct links to experts, farmers, operational quarantine officers etc.; often with wide “social” network in industry, agriculture, agencies, and scientific disciplines. From time to time receives technical advice from managers and diagnostic specialists.
j. May have access to modest, synoptic, reference material.
Formal qualifications vary, commonly basic degree or diploma. Experience is advantageous but not essential.

Specialist

a. Capable of recognising symptoms, causal agents, species and sub-specific entities.
b. Deep level of knowledge of taxonomy and diagnostics as disciplines and of taxonomic groups in which specialises. Interested and passionate. Familiar with scientific literature and aware of new, global threats, trends and resources. Activities often curiosity driven.
c. Advanced skills in in sampling, specimen preparation (e.g. slide making, isolation, culturing) bioinformatics.
d. Capable of identifying some specimens or processing some samples very quickly, but may use time-consuming techniques to process samples.
e. May have access to specialist equipment, software, literature. Commonly assembles or has access to specialist, reference material.
f. Capacity to identify varies from group to group (e.g. able to identify to family level in many groups, to species or lower in groups of specialisation). Capacity to confidently identify detections outside normal range of experience.

g. Capacity often transcends collection context and discipline.
h. Provides identifications, advice, reports and peer-reviewed, scientific publications, including creation of new keys, screening assays, and diagnostic protocols.
i. Peers are experts in the same or related areas of specialisation.
j. May participate in proficiency testing programs.
k. Provides training and mentoring.
l. Formal qualifications vary, commonly basic degree with specialised training, or post-graduate specialisation (e.g. MSc, PhD). Experience essential.

Diagnostic laboratory

Organisation/administration

a. Effective management and operational planning.
b. Accessible to users.
c. Provide reliable, consistent, timely results in line with expectations of clients.
d. Quality management systems, including systems for handling specimens, work flow, reporting, use of reagents and other consumables, waste disposal.
e. Good record keeping, sample documentation.
f. Connected to other diagnostic laboratories, e.g. as part of formal network, for cross-checking diagnoses, obtaining specialist assistance.
g. May have formal accreditation (e.g. for particular laboratory practices, use of particular protocols) from national accreditation bodies.
h. Has internet profile, describing capabilities, etc.
i. Provides conducive work environment.
j. Adequate funded. Preferably provides a free diagnostic service but can be fee-for-service.

Technical

a. Properly equipped, e.g. microscopes for examination of insects, facilities for storing specimens and samples, equipment for performing diagnoses.
b. Well-maintained reference collections and samples.
c. Maintain up-to-date "library" of manuals and other reference materials.
d. Facilities may be discipline specific, e.g. isolation, culturing, extraction and molecular for micro-organisms.
e. Good infrastructure, including physical design, security, electricity, water, internet access.

Skills

a. Staff includes diagnosticians with formal qualifications, trained in use of protocols and techniques, and experience.
b. Diagnosticians linked with professional counterparts through peer networks.
c. Utilise internationally accepted, locally validated protocols and techniques (e.g. IPPC standards).
d. Includes skills across diversity of disciplines.
e. Staff development programs, including training and systems to confirm proficiency.
f. Staff produce peer-reviewed, scientific and technical publications.
g. Skills and performance recognised, e.g. by significant organisational, national or international achievement awards.

The Forum did not form a view on standards which are appropriate and achievable for diagnosticians and diagnostic laboratories in ASEAN member Countries. However, it was generally accepted by Forum participants that, in general, formal ISO certification was not

yet feasible for diagnostic laboratories in the region. This was principally because of the cost of achieving and maintaining accreditation (including the time commitments) and the paucity of regionally validated diagnostic keys and protocols which could form the basis for accreditation.

8. **What are the major activities in the countries represented in the discussion group that will require diagnostic support (e.g. national market access priorities, international research collaborations, donor-funded projects)?**

   ASEAN Member Countries will require diagnostic capabilities to develop pest lists for market access proposals, support operational quarantine and agricultural production, identify emerging and outbreak pests, and underpin research. Forum participants did not identify specific priorities.

   In addition to the ARDN Project, projects funded by the Republic of Korea (managed by the FAO Regional Office, Bangkok, for benefit of Thailand, Cambodia, Lao PDR, Myanmar and Nepal), Asian Development Bank projects in Cambodia, Lao PDR and Myanmar, New Zealand (principally for Indonesia), Japan (JAIF, for all ASEAN member Countries), Australia (ACIAR/ Plant Biosecurity Cooperative Research Centre, involving Thailand, Cambodia, Lao PDR and Myanmar) and the STDF (most ASEAN Member Countries), and bilateral cooperation between Malaysia and Thailand, are anticipated to assist in the development of diagnostic capacity in the South-east Asian region. Coordination of these initiatives will improve outcomes for participating agencies. In general, these projects support development of skills rather than the creation of regionally validated, diagnostic keys and protocols.

9. **What kind of support will be required (e.g. identification of large number of samples, confirmatory diagnosis of representative specimens)?**

   Within ASEAN member Countries, diagnostic resources will be required to support both assessment of large numbers of specimens and samples (e.g. as a result of area freedom surveys for mango pests, monitoring of fruit flies) and confirmatory diagnostics. Confirmatory diagnostics of small numbers of specimens and samples will be required at the international level.

10. **What are the barriers to making the ASEAN Regional Diagnostic Network functional and useful to the countries represented in the discussion group?**
11. **What can be done to overcome these barriers?**

    Forum participants recommended the following to operationalise the ASEAN Regional Diagnostic Network:

    a. Develop a database of diagnostic expertise available to ASEAN Member Countries.
    b. Develop the ARDN website and provide advice on capabilities and limitations of the Network.
    c. Develop and publish protocols and standard operating procedures for diagnostic activities. This could be achieved via the ARDN website. It would be effective initially to promote (a) protocols and procedures which have been published previously and which have proved applicable in the ASEAN region; and (b) the anticipated IPPC Diagnostic Manual.
    d. Develop a document setting out acceptable procedures for the international movement of pathogen cultures. This is restricted or not permitted between many countries. However, by sending cultures, countries without molecular laboratories can make use of

molecular diagnostic technologies and culture material can be deposited in offshore repositories.

e. Provide ARDN Project Country Focal Points with information enabling them to promote national diagnostic networks. The establishment of a national network should be a pre-requisite to countries making use of the ARDN.
f. Initiate a pilot proficiency testing activity, based on voluntary participation and confidentiality of results, to demonstrate the feasibility of proficiency testing within the ASEAN region.