

Five project success factors in developing surveillance capacity in PNG



Dr Jonathan Happold (second left) with PNG CVO Nime Kapo (second right), Dr Brendan Cowled (end right), NAQIA staff and villagers.

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Abbreviations

CVO	Chief Veterinary Officer
DLO	District livestock officer
EAD	Emergency animal disease
DAFF	Department of Agriculture Fisheries & Forestry
NAQS	Northern Australia Quarantine Strategy
NAQIA	National Agriculture Quarantine and Inspection Authority
OCVO	Office of the Chief Veterinary Officer
OIE	World Organisation for Animal Health
PLO	Provincial livestock officer
PNG	Papua New Guinea

The Challenge

Talk to any animal health expert and they'll tell you that efficient and effective disease control requires a good epidemiological surveillance system. But how do you go about creating the foundations for developing such a system? Moreso, how do you develop the foundations for a national surveillance system in a developing country with limited resources and remote villages spread over vast, inaccessible areas? This was the problem Papua New Guinea's (PNG) National Agriculture Quarantine and Inspection Authority (NAQIA) faced in 2009. This case study describes how NAQIA and PNG's Chief Veterinary Officer collaborated with AusAID¹, the Department of Agriculture Fisheries & Forestry (DAFF) and PNG provincial livestock officers to implement a solution, and identifies a five factors contributing to the project's success.

How do you develop the foundations for a national surveillance system in a developing country with limited resources and remote villages spread over vast, inaccessible areas?

Some background on PNG and animal health

Animal production is important to Papua New Guinea—it meets much of the population's dietary protein requirements, is very important socially and culturally and forms the basis for a small but important cash economy for rural people. PNG also sustains commercial pig and poultry production industries.

As emergency animal disease (EAD) events have the potential for significant impact on animal production, an EAD outbreak could

have devastating social and economic impacts for the country. While PNG has experienced EAD events in recent years (e.g. Newcastle's disease in chickens), other EADs not currently found in PNG also threaten its animal health and production. Specifically, EADs associated with incursions of trans-boundary diseases such as classical swine fever, rabies and avian influenza (H5N1), are regularly found in parts of the South-East Asia region to which (geographically) PNG belongs. Potential incursions of these diseases into PNG would also threaten Australia's biosecurity due to PNG's proximity.

Adding to this transboundary disease risk is the fact that PNG faces particular challenges as a developing country in resourcing its government veterinary services and animal health system. As a case in point, Nime Kapo, PNG Chief Veterinary Officer (CVO), is one of only three veterinarians in PNG's public service. He has also candidly described the challenges facing government animal health workers in an interview with the PNG-Australia Alumni Association. In the interview he recalled how, as a NAQIA officer, he routinely travelled for weeks at

¹ AusAID is the Australian Government agency responsible for managing Australia's overseas aid program.

a time to provide veterinary services in the remote border areas of Sandaun Province. A quick check on Google™ reveals that Sandaun is a huge area of 36,300 square kilometers—roughly the size of Taiwan—spanning rugged mountains, steamy lowland jungles and scenic tropical coastlines. Few of the coastal towns are connected by road, and most of the inland districts can only be accessed by light aircraft or vessels reaching the Upper Sepik River.

Despite the considerable challenge of servicing such vast and inaccessible regions with limited staff and resources, CVO Kapo and other livestock officers are not only keen to take on this task, but also to bring PNG's surveillance reporting up to international standards. PNG is fully aware that to meet the World Organisation for Animal Health's (OIE) reporting requirements for trade in animal products, and to mitigate transboundary disease risks, it must begin building foundations for the development of a more robust surveillance system—one fully capable of supporting early emergency animal disease detection and response.

To build these foundations, CVO Kapo and NAQIA partnered with DAFF's Office of the Chief Veterinary Officer (OCVO) in an AusAID-funded project. The OCVO's Drs Brendan Cowled and Jonathan Happold worked closely with NAQIA to design and implement strategic surveillance project activities. These activities were undertaken in 2010, and the project elements and identification of factors that contributed to the project's success are described below.

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Success factor #1: Building on existing relationships and knowledge

The project gained leverage from existing Australian–PNG partnerships created to work towards achieving international development goals. Australia has close links with PNG, and in 2008 both parties signed the PNG–Australia Partnership for Development.² Under this agreement, Australia and Papua New Guinea are working together in close cooperation to progress PNG development priorities such as strengthening the public service and improving health outcomes. The project described here involved both strengthening public service animal health surveillance capacity, and reducing the risks posed to human and animal health by EADs (particularly zoonotic diseases). Thus, it clearly aligned with Australian–PNG development goals, and was successful in gaining AusAID funding.

² <http://www.ausaid.gov.au/country/partnership/png.cfm>

Analysing relationships within the PNG animal health system was also important for the project's design. NAQIA has several functions, one of which is to respond to and manage EAD events such as incursions of trans-boundary diseases. Like most animal health authorities, NAQIA relies on passive surveillance to detect EAD events and, as such, relies upon provincial governments to report these events to NAQIA's central office. Provincial Livestock Officers (PLOs) are employees of the provincial governments and are responsible for livestock production (including health) in their province. While these livestock officers work outside of the NAQIA organisational structure, they are very much part of the animal health system, since NAQIA relies on them for provincial-level

Provincial Livestock Officers...work outside of the NAQIA organisational structure (yet) they are very much part of the animal health system...

reporting of disease events. Thus, designing any surveillance training or reporting system that ignored the relationship between NAQIA and PLOs would have neglected an important network link in PNG's animal health and surveillance system, and resulted in sub-optimal surveillance outcomes.

As DAFF and NAQIA—through the Northern Australia Quarantine Strategy (NAQS)—have successfully worked together in the past on surveillance, it made sense to use this

partnership again to further build PNG's surveillance capacity. This allowed DAFF staff from the Office of the Chief Veterinary Officer (OCVO) to draw on their knowledge of past NAQS surveillance surveys and training in PNG, and enabled them to work more effectively with NAQIA in planning and implementing new training and system changes. For example, past technical assistance has seen DAFF provide basic field epidemiology training to NAQIA animal health personnel and PLOs, with a focus on disease recognition, animal handling and sampling techniques. Thus, DAFF trainers had a high level of awareness of trainees' knowledge and prior surveillance learning, and had observed trainees applying this knowledge during survey activities.

Because of the existing relationship between NAQIA and DAFF, DAFF was also aware of recent changes in PNG's national surveillance activities, and the additional training needs that might be required by the new system.

In the past, DAFF supported regular active surveillance by NAQIA, but only within zones specified by contract. However, seeking improvement in surveillance outcomes, both DAFF and NAQIA acknowledged limitations of the former zone-based NAQS surveys. For instance, the system prevented central office from having a good understanding of the disease status in places not surveyed. Also, a lot NAQS survey results were negative, which made it very difficult to make inferences about the disease status of the whole population.

To address these limitations, a new system was implemented whereby supported NAQIA surveillance is guided by an annual work plan agreed upon with the OCVO. Under the new system, NAQIA has gained more freedom to respond to disease reports flexibly, and to target diseased animals (rather than routinely sampling healthy animals). The new surveillance has also already seen

surveillance activities expanded outside traditional zones, allowing new information on disease risks to be gathered.

However, while the new system clearly allowed a broader range of surveillance information to flow in from the provinces to NAQIA Central Office, it also demanded a deeper understanding of surveillance from PLOs than that required by the zone-based survey system. That is to say, general surveillance required a more informed understanding of surveillance principles, reporting and design than most PLOs were trained in. Training workshops were thus seen as an

effective method by which to address this gap.



Thick foliage in PNG

One of the DAFF trainers for the PNG project, Dr Jonathan Happold, summarised the training aims as follows:

A really big part of what we wanted to achieve was to make PLOs aware of how important their job is and what they contribute to national surveillance, and to

understand their role in the bigger picture of surveillance and national animal health status. It was particularly important that trainees understood how their contribution would fit in with regards to reporting negative surveillance. It's human nature for someone in a remote provincial area to think that there's no point in bothering the big boss in Port Moresby to report that nothing's happening. Whereas one of the key points we're trying to get across is to say that it's better to be able to give an indication of how much confidence you have in your knowledge about the absence of disease. That is, how much of a chance you've had to get around and look at animals and talk to people and find out things. If a disease was present, that's obviously significant, but if it's not, that's still a useful thing to communicate.

Success Factor #2: A contextually sensitive gap analysis

An analysis of the relationship between NAQIA and PLOs made it clear that for PNG to have an effective and efficient surveillance system, surveillance communication between PLOs and NAQIA had to be optimised. Achieving this required more than just designing a better reporting system and providing training in its use. Instead, what was needed was something that would create PLO engagement with national surveillance objectives, and nurture a distributed³ surveillance network comprising NAQIA and PLOs—thus

³ Here 'distributed' is used to mean 'spread over an area'.

encouraging communication and collaboration to achieve shared animal health goals. Accordingly, a surveillance training workshop for PLOs—one which both clarified the need for and goals of surveillance, and which highlighted their essential role within the national animal surveillance system alongside NAQIA—was designed.

As mentioned above, it was recognised that PLO training was necessary both to support the new NAQS surveillance arrangements, and to develop a more robust epidemiological surveillance system. To form part of a surveillance network with NAQIA, PLOs needed to fully understand the rationale behind undertaking sampling and other forms of intelligence gathering. This would allow them to better communicate with the public, NAQIA and each other about surveillance, and would give them the knowledge to competently design and undertake appropriate surveillance activities.

Dr Happold explained:

The focus of the training was on general surveillance. Providing an understanding of why surveillance is important, and why the detection and reporting of surveillance information (even negative surveillance) is necessary for establishing animal health status in the country. The training also explained the different types of surveillance information you can collect, different methods, and their various strengths and weaknesses. There was also a focus on explaining how this information should be reported to central office, so that information could then flow back to the provinces about disease status.

As discussed elsewhere here, training that provided a deeper understanding of the principles and rationale for surveillance greatly increased PLO and NAQIA officers' motivation and capacity for further building surveillance networks in their own provinces.

Aside from training requirements, a gap analysis conducted by DAFF and NAQIA also identified the need for a better system of collecting epidemiologically sound data—one that could be adequately and meaningfully interpreted to reflect the disease status of the country. This saw DAFF and NAQIA sit down together—months before any training took place—to determine relevant and acceptable surveillance methods for PNG, given the country's unique social and physical features.

In addition to surveillance methods, new tools for collecting, reporting and recording epidemiologically sound disease data were required. The tools needed to be compatible with PNG's use of the TADinfo database for disease information management, while also being manageable for NAQIA staff and PLOs who often work and travel in remote areas, and without computer access.

Success Factor #3: Joint design of surveillance training, materials and methods

Following the gap analysis discussed above, the OCVO and NAQIA worked together to determine relevant and acceptable surveillance methods and tools for collecting and reporting disease data, and to develop training that would support the implementation of these. Consultation between NAQIA and OCVO about training structure and surveillance needs was pivotal for successful outcomes, Dr Happold explained.

NAQIA and DAFF's assessment of the surveillance system in PNG, and the ways in which it could be improved, really informed our training objectives. But to further refine what we wanted to achieve in this workshop, we relied heavily on NAQIA's assessment of what they thought was the current level of knowledge and capability for surveillance among trainees, and what the desired level would be.

The training design then evolved from combining NAQIA's very close understanding of trainees, their work environment and cultural context, and the resource limitations constraining them, with a more technical epidemiological perspective of the important concepts and elements of a surveillance system. An initial visit to PNG and communication over several months leading up to the workshop resulted in the two sets of knowledge meshing together really nicely.

An initial visit by DAFF to PNG allowed excellent planning and preparation of the training package, allowed DAFF staff to gain a good appreciation of PNG biosecurity, and also enhanced NAQIA learning by allowing face to face discussions about the development of training materials. The pre-training visit and regular communication before and after training also strengthened inter-agency relationships.

CVO Nime Kapo, was keen for training to paint a realistic picture for trainees of surveillance activities as they would happen in the field.

Training materials were first drafted by NAQIA and then jointly refined. From the beginning, CVO Nime Kapo, was keen for training to paint a realistic picture for trainees of surveillance activities as they would happen in the field.

Accordingly, the introduction of course subject matter was designed to follow the sequence of events that would occur, and issues that would arise, as officers undertook their work in the field. Thus, the course

content moved from disease incidence reports, to investigations, to sample collections and dispatch, to disease diagnosis, to information/data entry and management and interpretation, to reporting in an acceptable manner.

NAQIA also supported the use of the draft field reporting tools during training, and demonstration of their use in the TADinfo database, so that a focus on the end uses of surveillance reporting was there right from the start.

At the training in Lae (May 11-14, 2010) PLOs from 16 of 19 PNG provinces, along with six regional NAQIA staff, attended the workshop as trainees. The trainers' intention was to ensure that a representative from each of the 19 provinces attended. Five central office NAQIA staff and two DAFF OCVO staff acted as trainers during the workshop.

While training included a number of presentations by OCVO and NAQIA, the two days of class-based activities placed an emphasis on interaction and participatory design. For example, trainers would ask trainees (arranged in small groups) to brainstorm what they already knew about surveillance. Once trainees had listed all the techniques they'd heard of and used, the lists were then used to discuss as a group all the different methods for obtaining surveillance information.

Both NAQIA and DAFF felt that a participative and interactive approach, and use of the Socratic method (guided questioning)⁴ were appropriate, in order to gauge trainees' prior knowledge and learning, and to build relationships between the officers, most of whom had never previously met face-to-face.

Happold elaborates:

We might ask them (trainees) to look at their lists and discuss all the strengths and weaknesses of each surveillance technique, so that they could apply theoretical concepts of 'coverage' and 'representativeness' of a case in group discussion. This also gave participants an opportunity to discuss what methods did and did not work in their own work context or environment. It was also useful for trainers, helping the OCVO to gain further awareness of what surveillance work NAQIA and PLO staff are already doing in PNG.

Because we made it interactive, people really engaged. The break-out sessions were certainly lively and dynamic, and trainees really contributed a lot, both to the training and building relationships between staff.

There was also very practical discussion of the steps to take if a disease was suspected in an area, and the things that PLOs would be responsible for—both in terms of their job and legal responsibilities, and in terms of what preliminary reporting and investigation to undertake of something they might suspect was a disease incident.

Both NAQIA and DAFF trainers felt it was important that theoretical surveillance concepts were related to trainees' environment and experiences, and designed questions and examples centred around PNG. This created relevance, context and

⁴ For illustration of the Socratic method see: http://www.garlikov.com/Soc_Meth.html

meaning around the new and abstract ideas being presented.⁵ Happold explained:

...we might introduce some broad theoretical concepts about the reasons for doing surveillance, but then bring it right back to their own experience by asking 'what's been done in PNG over the last 40 years? And what was good about that or what could be done better?' We wanted to relate the general concepts to things that trainees could really relate to, and (where possible) use real world examples about outbreaks that have actually occurred in PNG— like the recent Newcastle disease outbreak—to demonstrate the more theoretical points.

Two new surveillance reporting templates were also presented to trainees, although these were in 'draft' form so that trainees could assist with their development. One template was a routine weekly province report, and the other an outbreak investigation report. The latter is aligned with OIE reporting requirements (e.g. number of animals affected, number dead animals, number of healthy animals) so that this basic information can be provided in reports to the OIE.⁶ The templates were not only designed to fit in with OIE reporting requirements, but local requirements (such as the use of TADINFO), resources and methods of surveillance. Templates were also designed to be relevant to local production systems and disease risks.

Trainees trialled the templates by completing them during classroom scenario exercises, and a number of minor alterations were made to templates following trainee feedback.

In the scenario exercises, trainees were presented with three to four scenarios which were fairly typical of disease events that might be encountered during a week in the life of a PLO. CVO Nime Kapo was able to provide very realistic scenarios based on his local knowledge and experience as a NAQIA officer in Sandaun Province. Trainees had to fill out the report they would file to NAQIA based on the week's events, and then discussed in groups how they'd come to the conclusions they'd drawn from the intelligence provided. This gave them an opportunity both to road-test the template, and to discuss a whole range of issues around inference-making.

⁵ This approach is based on a sociocultural theory of learning. See Brown, J., Collins, A., & DuGuid, P. (1989). Situated Cognition and the Culture of Learning. *Educational Researcher*, 18, 32-42.

⁶ Lack of animal health reporting capacity is a trade facilitation issue, as both international and national legislation may require trading partners to meet animal health reporting requirements of the OIE.

Success factor #4: Monitoring trainee feedback

During classroom sessions, NAQIA and DAFF trainers were constantly monitoring trainees' knowledge and learning, and adapting the training to trainees' needs. Dr Happold explained:

We used scenarios or examples of surveillance of particular relevance to trainees to find out the way they're thinking about surveillance problems and how well they're able to relate a particular surveillance objective with a particular surveillance activity. Usually their answers or discussion inform trainers whether trainees require expanded explanation or if they have gaps in knowledge. Trainers were constantly informally assessing trainee understanding and working to build it up from that level.

The joint refinement of training and reporting materials also continued throughout the classroom sessions and during fieldwork, when materials were used in practical, real-world settings. Changes were made based on the materials' observed suitability in the field, and through listening carefully to feedback from trainees. Class training materials (in English) were also made available in print form, so that trainees had a retrievable record that they could refer back to, and could also use as a resource to provide training to other officers in their provinces, such as district livestock officers.

Written materials also provided an additional resource for overcoming any language barriers that interfered with learning and participation. However, Dr Happold indicated that language was not a particular issue for the trainees he observed.

Language didn't create an impediment to the training, although we were aware that English was their second language and that we had to speak slowly and clearly.

However, concerns about the language barrier further supported the case for using interactive training methods more responsive to feedback, rather than simply presenting information to trainees.

After spending two days in the classroom, trainees were given the opportunity to put theory into practice while visiting a number of villages in the Markham Valley near Lae. Individual trainees were given the task of obtaining information to assess the status of that village (or area) in terms of the disease status of livestock. This required them to make decisions about who to talk to, how to go about obtaining information, and the types of questions they might ask. Different question types might be used to get demographic information about what types of animal were being raised in the district, as opposed to information about disease or production issues. While trainees' conversations with villagers were in their native language, NAQIA staff provided interpretation for Drs Happold and Cowled.

Travelling on the bus to the next village, trainees and trainers then discussed and provided feedback on the field surveillance task, and identified any areas of difficulty.

Dr Happold said that the trainees performed well, and added that it was, 'not an easy thing to go out there and ask questions without a structured questionnaire and get general surveillance information.' He also witnessed officers using the training as an additional opportunity to undertake extension work, distributing posters and speaking with villagers to raise awareness of the signs of disease and the importance of reporting disease to village/district animal health officers. An important message, says Dr Happold.

Communication skills were also enhanced by the training, partly due to the greater confidence PLOs felt in knowing their role in PNG's animal health surveillance system, and knowing why they were gathering specific information. Officers also felt more confident in their ability to explain the purpose of questioning to villagers.

The system is sustainable because PLOs undertake surveillance activities as part of their routine work.

Success factor #5: Sustainability

The surveillance training and reporting system implemented have enabled an economical and simple (yet robust) way of maintaining a regular flow of epidemiologically sound data from the field into NAQIA's central national animal disease database. The training delivered to officers has improved their capacity to effectively conduct outbreak investigations and, in turn, provide NAQIA with data adequate for both disease management and international reporting requirements.

The system is sustainable because PLOs undertake surveillance activities as part of their routine work. Also, since the newly implemented reporting system was comprised of the knowledge, imprimatur and tools to routinely report animal health status in a province, the system itself will not require additional resources now that PLOs have been trained in general surveillance. In addition, trained PLOs are now able to share their training with district livestock officers (DLOs), and arrange surveillance networks with them. While there is only one PLO in each province, each province is divided into a number of districts, and each district has a district livestock officer.

The project outcomes are also sustainable because they have strengthened NAQIA's institutional capacity by improving the agency's organisational, human resource and technical capabilities. The training provided provincial staff and NAQIA field staff with the technical knowledge to recognise and competently report animal disease outbreaks. Furthermore, training increased the number of PLOs with the ability to detect animal disease outbreaks, and since PLOs have a

wide geographic reach and frequent contact with provincial livestock owners, this has markedly increased NAQIA's overall capacity to rapidly detect and respond to animal biosecurity emergencies. In addition, senior NAQIA staff gained further experience in developing and delivering surveillance training packages, and are now using this expertise in self-funded surveillance training activities.

Sustainable outcomes were also planned via the project's use of a form of cascade training. Cascade training is a process that provides the competence required to ensure the institutionalization of organizational change. By training NAQIA and PLO officers in undertaking and communicating surveillance for national surveillance purposes, the project has provided the competence required for institutionalized organizational change in the way that NAQIA and other livestock officers undertake and report surveillance. As an outcome of this institutionalized change in surveillance reporting, PNG will be able to determine its animal disease status with more confidence. This will in turn enable PNG to respond more readily to requests from foreign governments and provide more data to international bodies, potentially facilitating greater market access and trade.

PLOs are now seeking funding from their own government to support annual meetings where PLOs can discuss animal production issues (including health) face-to-face, and collaborate to address issues.

Training feedback also suggests that the project will result in long-term change. PLOs reported that they were motivated to do more to improve animal health due to the workshop training changing their perception of their role in the national animal health system, and of what they could achieve collaboratively. They also reported the view that the training and potential developments from it (e.g. DLO networks) would be of great benefit to animal health in PNG. More importantly, however, these changed perceptions have already resulted in action that has the potential for long-term change.

Specifically, having been provided with the opportunity to recognise the value of face-to-face meetings, PLOs are now seeking funding from their own government to support annual meetings where PLOs can discuss animal production issues (including health) face-to-face, and collaborate to address issues. Dr Happold agrees that despite the costs and logistics involved, this type of meeting is very much worthwhile.

Because officers from remote areas needed to be flown in to attend...there's certainly substantial logistical challenges and expense involved in arranging this sort of meeting in a country like PNG. However, there was a lot of positive feedback from trainees about the benefits of having all the PLOs together in one room, and I think—for perhaps the first time—participants felt they were part of a national animal health network, rather than isolated individuals in a system.

That feeling of being part of a network is naturally very empowering and motivating, since groups have more resources than an individual and can achieve through collaboration what individuals cannot.

Project activities also further established the inter-organisational partnership between Australian (DAFF) biosecurity services and NAQIA, and have provided for ongoing knowledge-sharing and dialogue between the agencies. Also, a number of trainees have begun planning the establishment of surveillance network systems within their provinces, and will be able to use their training to assist them with this task. Future collaboration between DAFF and NAQIA to assist with the development of these networks is not out of the question, Happold commented:

We felt that the key links to make in this initial building of the country's surveillance communication structure were between NAQIA central office and the provincial livestock officers. Then, in future, a key activity would be facilitating communication of surveillance information between district (village) livestock officers and PLOs. Obviously, PLOs can't be everywhere, so they're reliant on these sorts of passive reports coming through to them from the villages.

At the training workshop, PLOs discussed ways in which they could get surveillance information from DLOs by establishing links or networks with districts and villages. Showing considerable initiative, one trainee has already sought funding from within his province to support the development of networks at the district/village level, and has a conceptualised his own simple but effective network model.

However, both NAQIA and DAFF are aware of the remaining constraints faced by PLOs in undertaking surveillance and reporting in their provinces. Dr Happold explained:

As trainers, we're aware that there may be some limitations in terms of the quality of the information gathered, and the ability of PLOs to know what's going on within all of the different villages in a district or province—bearing in mind that a village might be two days walk from the nearest place where authorities could be contacted and notified of disease.

They face the problem of working in very large provinces in which it's very difficult to reach a lot of villages, and there tends to be widely varying levels of communication and accessibility in villages and districts. Some PLOs don't have transport, and some don't have the operating budget to get out and form networks with DLOs.

So there's lots of limitations, but the aim is to get the surveillance communication structure in place despite these.

While acknowledging these constraints, Dr Happold said it was outside the scope of the project to attempt to address logistical problems posed by national infrastructure. It was also outside the scope of the project to develop the

specificity or sensitivity of PNG's surveillance. PNG's current limited laboratory access would, in any case, preclude such an aim.

Rather, the project focus was on improving surveillance networks, knowledge and communication, and bringing about institutional change, so that over time, the timeliness and quality of surveillance information in PNG would improve. Against this objective, the project has arguably been successful, and has built a framework which will support future surveillance development in PNG.

Summary

While both DAFF and NAQIA are aware that much work remains to be done in developing PNG's animal health surveillance to OIE standards, it is clear that the project described here has accomplished progress towards this aim.

The collaborative project achieved its objective of building the foundations for the development of a more robust national animal health surveillance system. This was accomplished through the delivery of a training workshop and the development of a surveillance system and tools. These activities resulted in the creation of surveillance networks and improved surveillance knowledge and communication, and also brought about institutional change which will improve surveillance information and reporting in PNG.

Five factors were identified as important to the success of the project. The first was gaining leverage and insights from existing partnerships such as those formed through NAQS and international development partnerships. The second success factor was a contextually sensitive gap analysis which focused on local institutional practices and relationships in the animal health surveillance system. Knowledge and analysis of the existing system was important in determining appropriate areas and methods for development, and suitably sustainable resources for this development.

A joint gap analysis, and collaborative development and delivery of surveillance training, materials and tools, was the third project success factor. Both NAQIA and DAFF contributed elements to the design and delivery of project activities that were essential for achieving desired outcomes. The fourth success factor—monitoring trainee feedback—allowed further refinement of surveillance training and tools, and was also important for gauging trainee understanding and attitudes. Monitoring understanding was particularly important given the status of English (the classroom language) as learners' second language.

Finally, the fifth project success factor—sustainability—has ensured long-term surveillance outcomes by creating institutional change, local engagement and increased institutional capacity. Furthermore, the system changes implemented are economical and do not demand additional resourcing.

While these five success factors are recognisably common in general to successful development projects, this case study has detailed how each factor contributed to successful outcomes within the specific context of improving animal health surveillance and reporting in PNG.

However, while it must be recognised that animal health surveillance systems and development needs vary according to settings, it is hoped that this case study will be of some assistance to others planning and implementing similar projects. For any further information, please contact the AI Toolkit team via the website.

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Piglets in PNG