Executive summary

The Government of Australia (GoA) is committed to raising the international standards of development effectiveness in line with commitments to the OECD DAC, the PNG Commitment to Aid Effectiveness and the Accra Agenda for Action. The Australian Agency for International Development (AusAID) undertook an independent, thematic evaluation of its investments in three Papua New Guinea (PNG) research institutions that form part of Australia's contribution to development in PNG:

- the Institute of Medical Research (IMR) Core Support Program, Phase 2
- the National Research Institute (NRI) Support Program
- the Agricultural Research and Development Support Facility (ARDSF)

The thematic evaluation was implemented collaboratively by the Government of PNG (GoPNG) and Government of Australia (GoA), to assess the relevance, effectiveness, efficiency and sustainability of Australia's contribution and to learn lessons from past activities that will inform and identify opportunities to improve both collaboration and understanding among all stakeholders on how research can be better used to improve service delivery for PNG citizens, especially rural communities that comprise more than 80% of the population.

**AusAID contributions to research on PNG are relevant where they deliver public goods**

Vision 2050 specifically identifies research as a core strategic development area cutting across the seven strategic focus areas. The public investment budget strategy proposed in Vision 2050 includes 5% allocation to research and development. This recognition of the role of research for evidence-based policy making and strengthened service delivery is expanded in the Development Strategic Plan 2010-2030 (DSP). For example, research, science and technology is identified as one of the development strategies with a target of doubling public and private sector investment in science and technology through strategies that include strengthening PNG research institutions and establishing partnerships and alliances to meet PNG needs. The Medium Term Development Plan 2011-2015 (MTDP) sets out specific actions for research, science and technology.

So at a general level AusAID support to the Institute of Medical Research (IMR), the National Research Institute (NRI) and the Agricultural Research and Development Support Facility (ARDSF) is relevant to PNG. However, there is a broader question about the relevance of public investment in research. GoPNG investment in research should result in a net social benefit or public good. AusAID investment in PNG research should result in both a net social benefit and a clear development benefit that complements what PNG is already doing itself. Public investment is justified if a net cost to the private sector means that a research program will not proceed without government funding, despite there being a net social benefit. The same criteria can be used for official development assistance (ODA) – only those research programs that provide a development benefit (which could be described as a regional or global public good) and would not otherwise be implemented should be considered for ODA support (see Annex 2). Where delivery of public goods is not clear, it may be more relevant to support users of research to strengthen the demand side (eg by resourcing institutions to commission applied research services or purchase extension support) rather than support the supply side (eg through core funding to NARS).

Evidence from IMR and NRI evaluations highlights that AusAID support is relevant to PNG and as a use of scarce ODA resources, AusAID investment in agricultural research through ARDSF is less straightforward.

**Effectiveness is strong at activity level but mixed at outcome level**

Evaluation of AusAID contributions to IMR, NRI and the National Agricultural Research System (NARS) in PNG identified effective delivery where the results of research are put into use. As demonstrated in the text box examples, results are delivered at activity, institution and national levels. In summary:

- there are many examples of effectiveness at activity level;
- institutional change is slow and complex but works with broad international partnerships;
- targeted budget support and competitive grants are effective modalities;
- research processes and communications are as important as research results;
- communication is critical for effectively using research results; and
- national outcomes are emerging from use of research results.

**There is a need to link supply and demand with a national research agenda**

Existing PNG research institutions represent a strong foundation to supply research results that support implementation of the MTDP, DSP and sector plans. However, this supply side has limited direction on the demand for research from GoPNG and other research users. Without this, research institutions lack focus and risk being ineffective. PNG research institutions would be more effective if GoPNG set a national research agenda to direct their programs (see boxes 6 and 12).
Where public investment is justified, targeted budget support is most efficient
Public goods are likely to result from research in public policy, public health and food security/climate change adaptation. Where that is the case, and relevant institutions have good practice financial management and governance, targeted budget support is the most efficient way of delivering Australian contributions to research in PNG. For example, targeted budget support for IMR, NRI and NARI contributed to organisations with overheads ranging between 22% (IMR) and 35% (NRI). This compares to 44% used for facility management and an AusAID technical adviser under ARDSF.

Partnerships enable research institutions to leverage AusAID contributions
When research institutions use international and local partnerships to develop and implement research activities, the AusAID contribution is efficiently leveraged. For example, IMR leveraged around PGK8 million of AusAID investment to attract more than PGK27 million in competitive research grants. GoPNG and AusAID support for research institutions delivering public goods covers the overheads that research grants will not support, and provides a mechanism for inducting young PNG scientists into research teams. The core funding also allows new programs to commence and demonstrate relevance before attracting competitive grants. For example, AusAID core funding enabled IMR to re-establish a strong respiratory disease program – dealing with the number one killer of children in PNG. This quickly led to international research grants that leveraged AusAID investment in an area directly relevant to reducing infant mortality in PNG.

IMR and NRI represent good value for AusAID investment
Rapid appraisal of AusAID investment in IMR and NRI demonstrated clear value for money. For example, using Value of a Statistical Life analysis, the break even point for the total IMR budget over the 2007-2010 period is around 190 lives saved. Since the outputs from IMR research in this period resulted in several changes to NDOH national treatment protocols and standards (eg pneumonia vaccine, treatment guidelines for severe malaria, rapid diagnostic tests, combination malaria therapy and monitoring bed net efficacy) it is likely the number of lives saved numbers in the thousands – the result is a sound return on investment.

Similarly, between 2005 and 2010 AusAID invested A$6.4 million in direct support to NRI. The direct support is equivalent to around 43 person years of inputs from PNG senior professionals, or an average of 9 FTE per year. Given the number of researchers working on NRI research during 2005-2010 and the leveraging of Australian funds with those of GoPNG and other donors (e.g. ADB, UNFEM and EU) the support to NRI represents a good return on investment. Measureable contributions to PNG public policy are attributable to NRI.

Research portfolios need consolidation to increase efficiency and effectiveness
PNG research institutions and AusAID research programs implement large numbers of small activities. For example, in the NRI research portfolio 50% by number are less than K20,000 in size – representing less than 8% of the value of proposed research activities. Only 3 activities are more than K250,000 in size – 6% of the portfolio representing 45% of its value. NRI activities for the National Land Development Program and HIV/AIDS Behavioural Surveillance Research are good examples of the scale needed for a sustainable and efficient portfolio. In IMR similar examples of a sustainable and efficient portfolio are found in the mosquito-borne disease program.

To increase the efficiency and effectiveness of work program planning there is an opportunity for government leaders and research managers to plan staffing and budget allocations to each pillar and theme in accordance with national needs. This could be informed by the nominal allocations proposed under Vision 2050 (for example education 20%, wealth creation and trade 15%, environmental sustainability/climate change 5% and community development 5%).

Efficiency is enhanced with good practice management
Research institutions need strengthened management to deliver within recurrent budgets. PNG invests an increasing amount of public funds in research & development. Funding levels are globally competitive to sustain agricultural research and development in PNG. The priority is effective management to deliver services within the available recurrent budget and communication of research results so they can be put into use.

Similarly at IMR – the science is world-class but management systems are not yet at that level. Additional finance and IT staff have been appointed in IMR and software procured for an accrual accounting system. The lack of good practice management systems puts at risk the growing workload of international and national grant-financed projects relevant to PNG. There is an opportunity for PNG research institutions to implement international good practice management certified to ISO9001.

The other management reform needed is reduction in overheads to ensure efficiency. For example, more than half NRI staff members have administrative functions – compared with less than a quarter in IMR. The large number of small activities diverts staff from focus on larger programs that provide economies of scale as well as opportunities for professional development of younger researchers and cadets.

The priority is effective management to deliver services within the available recurrent budget and communication of research results so they can be put into use.
AusAID needs discipline to focus support on new, institutional research programs

If the Australian aid program supports further research in PNG, that contribution should be made through targeted budget support and/or competitive grants schemes that enable new research programs to be implemented by selected research institutions. For example, the respiratory illness program at IMR or the education performance program at NRI. AusAID support should not be used for general recurrent funding – to ensure sustainability that is the role of GoPNG, levy payers and other beneficiaries in PNG. Nor should AusAID provide other funds for consultancies or specific projects through sector programs. As research institutions become stronger, AusAID will need the discipline across its entire portfolio to engage research institutions through targeted budget support and/or competitive grants schemes rather than through individual researchers or specific commissioned research and consultancies.

Some impacts are attributable to AusAID contributions to research in PNG

AusAID support to PNG research institutions results in impacts that are attributable to the Australian aid program. For example, between 2005 and 2010 AusAID contributions to research resulted in:

- Identifying limitations of 7-v pneumonia vaccine – saving NDOH resources (see Box 2)
- Identifying opportunities for 10-v pneumonia vaccine in PNG
- Drug resistance results informing NDOH policy and revised treatment protocols
- Improved malaria treatment for pregnant mothers and infants in PNG
- Highlighting the threat posed by TB in PNG and mapping HIV and STI incidence
- Maintaining world-class malaria vaccine testing facility in PNG
- Vector biology results demonstrating unique PNG malaria management needs
- Using disease surveillance to maintain PNG polio free certification
- Using clinical and operational research to enhance efficiency of NDOH programs
- Supporting training of more than 92 PNG scientists and growing professional staff 34%
- Attracting almost K30m new grant funds for medical research to PNG
- Debate on a competitive telecommunications sector - contributing 0.7% GDP growth in 2007 (see Box 3)
- Two pieces of enabling legislation from the Land Development Task Force - resulted in (see Box 8)
- Analysing PNG development performance from 1980 to inform Vision 2050 and making other contributions to plans that underpin GoPNG policy and sector plans
- Leading domestic observers for the 2007 election and identifying opportunities for improvement that the Electoral Commission is addressing for the 2012 General Election
- Developing monitoring instruments for universal basic education
- The analytical foundation for reform of intergovernmental relations and service delivery, enshrined in the Intergovernmental Relations (Functions and Funding) Act (PNG, 2009)
- Contributing to core HIV/AIDS behavioural surveillance for PNG
- Strengthening capacity of NARS organisations to engage with and service the needs of a wide range of stakeholders in agriculture and rural development
- Development by NARI of taro and yam varieties for improved food security (see Box 9)
- Pilot projects that enable smallholders to engage in the entire value chain (see Box 1)

Competitive research grants can deliver quick and targeted impacts to rural communities

The potential for competitive grants to deliver quick impacts is demonstrated by several activities under the Agricultural Innovation Grants Scheme (AIGS) supported by AusAID. For example, ADRA – a local civil society group in Morobe Province – works with 200 coffee and 1,000 cocoa producers to put results from existing research into use and so increase production volume and quality (see Box 1).

PNG research institutions are increasingly sustainable financially and technically

Vision 2050 proposed 5% of public investment be allocated to research and development. This commitment is confirmed in the DSP 2010-2030 and the MTDP 2011-2015. As an example of this commitment in practice, PNG invests an increasing amount of public funds in agricultural research & development. In 2009 GoPNG invested K36.5 million in the NARS through direct appropriations and regulated levies. This represented around 1.3% of agricultural gross value of production in that year – up from 0.8% in 2002. This level of investment is above the global average (1.1%) and less than the developed country average (2.6%) for public investment in agricultural research and development. Including the levies paid to research institutions – for example by the palm oil, coffee and cocoa industries – the amount of PNG public investment in agricultural research and development is consistent with global benchmarks. Provincial governments do not allocate sufficient funds to agricultural extension patrols and farmer training. However, current funding levels are sufficient to sustain agricultural research and development in PNG. It is the use of research funds that requires management.

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NARI received increased GoPNG development budget (public investment program PIP) support in 2009. Similarly IMR received increased GoPNG recurrent and PIP budget allocations in 2008, 2009 & 2010. This demonstrates the capacity of institutions to influence and engage at the highest levels of Government – one measure of a sustainable organisation. The AusAID share of the recurrent IMR budget is declining (from over 50% in 2007 to around 20% in 2010) as IMR increasingly attracts competitive grants for basic and translational (clinical and operational) research.

**Human resource recruitment and retention is a significant challenge**

Like other users of skilled professionals in PNG, research institutes struggle to maintain a sustainable staff to implement planned and contracted research activities. The key need is for champions or anchors to lead research and debate in each core theme or program area. Recruiting and retaining such staff is difficult when research institutions are not perceived as an employer of choice. For example, terms and conditions for NRI staff are not comparable to UPNG or NARI. Similarly, terms and conditions for IMR staff are not comparable to UPNG as required under section 18(3) of the PNGIMR Act (PNG) 1967. The absence of a response from DPM to salary and staffing proposals from research institutions threatens sustainability of core staffing and the capacity of PNG research institutions.

By implementing human resource management reforms, IMR has more sustainable human resources. For example, IMR strengthened organisation of leadership, appointed a Training Officer and engaged DPM on salary reviews. This allowed 34% growth in professional staff numbers between 2007 and 2010 and a reduction in voluntary staff turnover. Appointment of an IMR Training Officer complemented by Fogarty Foundation grants and the UPNG partnership, enabled IMR to support 50 summer interns and 24 BSc, Honours students (54% women) as well as 15 Masters and 3 PhD programs. This is part of a more structured approach to career development that several young PNG researchers identified as a positive change. In contrast, since 2005 NRI staff numbers have grown by 15% but just over half are administrative staff. Such a high proportion of administrative staff is unsustainable in a resource-constrained environment. With annualised voluntary turnover of research staff ranging between 8 and 12% per year, NRI needs to recruit more than 6 research staff as well as project staff each year in order to sustain growth. The introduction of a cadet scheme by NRI in 2007 resulted in 15 new researchers recruited in 3 years (27% women). NARI also uses a cadet scheme as a recruitment tool, with AusAID support enabling 6 cadets to complete training and join NARI as junior scientists. NARI also used AusAID support for postgraduate study programs of 8 staff.

In addition, research institute management should limit the amount of individual consulting that researchers conduct in their own right. Managers should focus the research development effort on large-scale, more complex programs that are professionally satisfying to the senior researchers. Larger programs also provide opportunities for young PNG researchers as team members because they have the scale to be able to attract and afford the transaction costs associated with international partnerships.

**PNG research institutions needs to strengthen partnerships to sustain success**

The increasing shortage and cost of PNG researchers is unlikely to be overcome during the life of the current MTDP. PNG research institutions should therefore establish additional, long-term partnerships with international research institutions and contract researchers to complement current staff and increase their capacity to deliver research results for PNG. IMR successfully does this through a Buttrressing Coalition of partner organisations that provide international post-doctorate staff, placed in IMR for 3-5 years, to support an agreed research program and mentor PNG researchers.

Competitive research grants and managed budgets for shared research provide practical mechanisms that AusAID can use to support research partnerships. For example, NRI finds the use of research pathways, comprising open-call, commissioned and collaborative research enables it to access other sources of research talent to implement its annual Research Implementation Plan. This approach is sustainable and fit for the current needs of PNG. It is an important opportunity to scale-up for better efficiency.

**Gender was not thoroughly mainstreamed but some gender impacts resulted**

AusAID support to research in PNG was not explicitly designed to advance gender equality. However, specific research programs particularly benefited women and children, and capacity development led to changes in research programs to ensure responsiveness to men, women youth and disabled. ARDSF specifically addressed gender as part of its support to capacity development in NARS organisations.

IMR research particularly benefits children and pregnant women (eg pneumonia, women’s sexual health, ITP-i and ITP-p work). This improves access of women and their children to health services that address their priority needs. Translational (operational and clinical) research increasingly addresses knowledge, attitudes and practices towards women’s sexual health as well as treatment and prevention of acute respiratory infections in infants and families. The opportunity to develop specific research programs that explore gender issues to inform
national decisions and ensure gender equality in evidence used for policy making is yet to be developed. This may be because governing bodies of research institutions in PNG include few women. For example, the boards or councils of NARS organisations include in total less than 10% women.

AusAID contributions to research in PNG were not designed to deliver women’s rights. However, there are several research themes that would benefit from a focus on gender. For example in land reform research supported by NRI there are questions about entitlements to land under kastom for women and their children resulting from marriages outside their clan. In education there are questions about gender differences in school attendance and basic education performance that NRI could sensibly research. In climate change there are research questions about the gender impacts of different climate change scenarios in each region of PNG that NARI and NRI could collaborate on.

**Performance management is not yet systematic or strategic**

PNG Research institutions do not yet use systematically collected monitoring data to support management decisions and inform annual planning. For example, none of the PNG research institutions supported by AusAID have quantitative plans or monitoring systems that systematically report variance from plan. IMR prepares an Annual Review to present a rapid appraisal of its work, the results and their relationship to the Activity Plan and Resources Schedule prepared for that year. No formal and systematic variance analysis is conducted for budget, personnel and outputs. Most research institutions monitor staff numbers and finances and some institutions (eg NARI) monitor activities and immediate outputs. None of the institutions systematically monitor results or conduct evaluations that allow annual performance review against their mandate and purpose.

**AusAID needs to resource proactive supervision and monitoring**

Evidence collected during the evaluation highlights the importance of monitoring to ensure effectiveness and efficiency, relevance of design and sustainability of results. Monitoring of support to research institutions against objectives should be an essential part of the position description for AusAID Program Managers.

**The quality of PNG research needs to be tested**

Few research results from PNG research institutions supported by public investment are published in international journals. IMR has the best record of this and both IMR and NRI use the number of international journal articles as a performance indicator in reports. To support learning and be relevant to PNG, the national research institutions need to communicate with many audiences – one of which is the scientific community, for whom international, peer reviewed journals are the test of quality and relevance. Whilst a PNG user focus for communication of research results is appropriate for the needs of PNG and the purpose of the national research institutions, it does not test the quality of PNG Research or its researchers. Nor does it provide professional development opportunities for PNG researchers or raise the profile of PNG research amongst international peers, research funders and donors.

**PNG research institutions should contribute more to national analysis and learning**

Effective public research organisations need political leadership as well as strong presence among decision makers to lift its profile and to make the required impact. For this to happen, PNG research institutions should collaborate to prepare and advocate a 5-year research agenda supporting the MTDP, DSP and Vision 2050 (see Box 12 and Box 6). The current work to prepare a national land development research framework that is overseen by NRI is a good example of this approach in practice. This research agenda should be proposed to the NEC. NEC approval implies government ownership of the plans and associated implementing budgets.

**Lessons learned**

Key lessons learned from the thematic evaluation of research in PNG relating to why AusAID supports research and how AusAID delivers contributions to research in PNG are summarised schematically in Chart 9 and include:

- Public investment to support research needs careful allocation
- Effectiveness comes from putting results of research into use
- Targeted budget support and competitive grants are effective modalities
- Competitive research grants can deliver quick and targeted impacts
- AusAID needs discipline to focus support on institutional research programs

Key lessons learned from the thematic evaluation of research in PNG relating to AusAID contributions to institutional arrangements and management for research in PNG include:

- Link supply and demand with a national research agenda
- Human resource recruitment and retention is a significant challenge
- Effective leadership is the foundation for success
- Partnerships are the future for PNG research institutions
- Research portfolios need consolidation to improve efficiency
• Efficiency will be enhanced with good practice management
• To add value and be relevant PNG researchers must communicate
• There remains a constraint on the demand side - how research results are used
• PNG has the capacity to support innovative knowledge management tools
• PNG research institutions are increasingly sustainable
• PNG Research institutions do not yet use evidence-based management
• AusAID needs to resource proactive supervision and monitoring
• The quality of publicly funded PNG research needs to be tested
• A clear exit strategy needs to be articulated by AusAID

Recommendations
Based on the three evaluations conducted to contribute to this thematic evaluation, review of many documents, interviews with national, provincial, civil society, private sector and research stakeholders, the lessons learned presented above and lessons from other research institutions, the independent thematic evaluation team recommends that AusAID:

1. **Support development of a National Research Agenda to link research supply and demand** – using existing support from AusAID, NRI could act as a catalyst to facilitate the Research Leaders’ Forum to better balance research supply and demand by drafting a national research agenda for presentation to the National Planning Committee to complement Vision 2050, DSP and the MTDP.

2. **Encourage establishment of an informal Research Leaders’ Forum** – PNG research institutions and universities should establish an informal Research Leaders’ Forum that is used to coordinate research and post-graduate training in PNG.

3. **Support the Forum to strengthen management of research talent** – the PNG Research Leaders’ Forum could work with Department of Personnel Management and the Salaries and Conditions Monitoring Committee to develop a competitive salary scale for PNG researchers.

4. **Support research where it is an integral part of an agreed Delivery Strategy** – AusAID should not provide further recurrent budget funding to GoPNG research institutions. Instead, AusAID contribution to research in PNG should support specific research programs that make a clear contribution to an agreed Delivery Strategy, deliver a clear public good and meet GoPNG priorities.

5. **Contribute to a National Competitive Grants Scheme** – AusAID should begin work with GoPNG towards a new initiative that finances a National Competitive Grants Scheme (NCGS). If needed, such a scheme could be managed in the interim by the existing systems and support arrangements of a program with dedicated grant management systems, regional teams and community development workers.

6. **Contribute to specific food security and climate change adaptation research** – given the importance placed on agriculture, food security and climate change adaptation in the MTDP 2011-2015, Government of Australia should consider providing resources from the food security and climate change adaptation budget measures to PNG for specific research programs relating to these sub-sectors.

7. **Exit recurrent budget support for research institutions** – as part of an effective exit strategy from the past PNG program, AusAID should make it clear to all research institutions that there will not be further Australian support for recurrent budget or capacity development after completion of existing programs.

8. **Use business volunteers to strengthen research management** – as part of the initiatives under the higher education schedule AusAID should support PNG research institutions to broker relationships with business volunteers.

9. **Equip Program Managers for supervision and relationship-building** – AusAID should ensure that its Program Managers have the skills, time and resources to take a more active role in supervision, performance management of contributions and relationship-building with PNG research institutions.

10. **Encourage review of governance arrangements for research** – as part of its policy dialogue with GoPNG, AusAID should encourage review of the governance arrangements for research institutions in PNG.
Chart 1: IMR health research is relevant to PNG


Chart 2: Not all research is relevant for public investment

Box 1: Putting research into use supports rural livelihoods

With support from the Agricultural Innovation Grants Scheme (AIGS), ADRA—a local civil society group in Morobe Province—is working with 200 coffee and 1,000 cocoa producers to apply existing good management practices to increase production volume and quality. To maximise price paid to smallholder participants, ADRA helps producers form cooperatives, which consolidate production, contract process, the products and market the produce. By doing this work themselves through the cooperative, smallholders double their price received and improve cash flow, reducing the need for expensive loans from collectors and traders. Higher prices paid to smallholders are complemented by productivity increases of up to 100% as a result of pruning coffee; using grafted, clonal cocoa plants; and good management practices. Lead farmers from other areas as well as technical officers from CCI and CIC are used to train smallholders.

As shown in the value chain above, the results include significantly improved income—for example smallholder coffee producers produce on average 18 50kg bags of parchment coffee per year and now earn around PGK4,500 per household from coffee alone. This income will continue to rise as productivity increases further in the next year as a result of renovation and management. Income is paid to cooperative members in relation to their production, effort and inputs—women receive cash income along with men. For many women participants in the ADRA activity, this is the first time they have received a formal cash income from their agricultural enterprises.

Chart 3: Targeted budget support is efficient for mature research institutions

As shown in the estimated overheads of different programs (2008), targeted budget support is efficient for mature research institutions. With AIGS, smallholders benefit from increased production and greater income. Without AIGS, overheads remain high, impacting the overall efficiency of research institutions.


Chart 4: NRI research portfolio is fragmented

The NRI research portfolio is fragmented, as shown by the distribution of project budgets (K'000). A significant portion of the budget is concentrated in a few large projects, indicating a fragmented approach to research funding. This fragmentation can affect the overall impact and efficiency of research efforts.

Source: NRI 2010 Research Implementation Plan
Box 2: IMR competitive grants leverage core support

During the 2007-2010 period IMR successfully competed for PGK27.3 million in research grants from national (eg NACS and PASHIP) and international (eg National Institute of Health [USA], Gates Foundation [USA], Wellcome Trust [UK], Swiss Tropical Institute [Suisse], The Global Fund) initiatives/organisations. IMR also successfully attracted capital investment, including PGK8.5m from Japan, PGK7m from Sustainable Development Program and PGK8.9m from public investment program (PIP) appropriations between 2007 and 2010.

GoPNG and AusAID core funding of IMR covers the overheads that research grants will not support, and provides a mechanism for initiating PNG scientists in research teams. The core funding also allows new programs to commence and demonstrate relevance before attracting competitive grants. For example core funding enabled the respiratory disease program to be re-established. After 12 months the program won a competitive grant to trial pneumonia vaccine for infants in PNG. This is highly relevant to PNG since pneumonia is the number 1 killer of infants.

International research grants target problems relevant to PNG – infant mortality (eg pneumonia vaccine and malaria treatments for infants), maternal health (eg malaria treatments during pregnancy, women’s sexual health) and emerging threats (eg disease resistance to first-line treatments used in PNG and resurgence of tuberculosis).

Chart 5: IMR is increasingly sustainable financially

Source: IMR Annual Reviews and Resource Schedules 2007 – 2010. HR data from Deputy Director Corporate Affairs

Chart 6: Publish internationally to test quality of NARS research

Annex 2 – Decision support tool to identify public benefits from research in PNG

**Existing technology and tools can contribute to addressing constraint**
- **Yes**: Do not invest in research. Contribute to adoption of existing technology and tools.
- **No**: Adaptive or applied research will not result in new technology or tools that contribute to development opportunity.
  - **Yes**: Do not invest in research. Adapt existing technology and tools to local context and contribute to their adoption.
  - **No**: Research likely to result in outputs that provide exclusive and rival benefits of interest to individuals, who are willing to share costs of research.
    - **Yes**: Contribute to creating policy and institutional environment that enables individuals & private sector to invest in research.
    - **No**: Research likely to result in private benefits, greater than costs, but cost sharing difficult due to fragmentation of demand.
      - **Yes**: Contribute to supporting environment that enables distributed networks to share costs and benefits of research.
      - **No**: Research likely to result in public benefits (non-excludable, non-rival), greater than costs, but limited to local and national stakeholders.
        - **Yes**: Contribute to strengthening national research institutions, with partners as needed, to conduct national research activities where results support higher-level development outcomes.
        - **No**: Research likely to result in public benefits (non-excludable, non-rival), greater than costs, relevant only to regional stakeholders.
          - **Yes**: Contribute to enabling regional partnerships to conduct research where results support regional development outcomes.
          - **No**: Research likely to result in public benefits (non-excludable, non-rival), greater than costs, relevant only to global community.
            - **Yes**: Contribute to global institutions and partnerships to conduct research where results support global development outcomes.

**Examples**
- Hand washing for hygiene
- Pruning, fertiliser for increased coffee productivity
- Rural road maintenance

**Examples**
- Cloned cocoa & agronomy to increase cocoa productivity
- Mobile phone applications to deliver health services

**Focussed private goods - eg**
- Certified good agriculture practices for food safety
- Property planning

**Fragmented private goods - eg**
- New varieties of commercial crops – eg potato, banana
- Watershed management plans
- Post harvest handling tools

**National Public Goods - eg**
- Sexual behaviour of those vulnerable to HIV/AIDS
- Education choices for girls
- Customary land reform
- Pneumonia vaccine for PNG

**Regional Public Goods - eg**
- Adaptation to climate change
- Pneumonia vaccine for PNG
- Peace studies for conflict zone
- Regional response to pandemic threats
- River basin planning

**Global Public Goods - eg**
- Malaria vaccine
- Global trade policy
- Strategies to prevent organised crime and drugs
- Reversing ozone depletion