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## 1 Acknowledgments

This report is dedicated to Dr John M. Schiller, Honorary Senior Fellow, Faculty of Science, School of Agriculture and Food Sciences, The University of Queensland, who passed suddenly in December 2017. His dedication and commitment to the people of Laos and the Mekong region over the last four decades cannot be overstated and he will be fondly remembered by many.

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## 2 Executive summary

The Lao Agricultural Research Fund 3 (LARF-3) is the third phase of an ACIAR-funded initiative that was first commissioned in 2005<sup>1</sup>. The primary goal of LARF-3 has been the delivery of a collaborative and competitive grant scheme for agricultural research in Lao PDR that could also assist in improving the research capacity of Lao research staff and their institutions.

The LARF-3 grant scheme was open to Government of the Lao (GoL) research agencies and universities in Lao PDR. Areas of research were to include crop and livestock production, fisheries research, forestry systems research, natural resource management, integrated agricultural systems research, and socio-economic studies related to agricultural production. All projects supported by LARF-3 were required to complement other ACIAR-funded projects concurrently or recently active in the northern and southern regions of the country with a particular focus on: (i) improved productivity of lowland farming systems; (ii) development of alternatives to shifting cultivations in the upland regions; and (ii) assisting with adaptation to climate change at the farm level through more efficient use of soil and water resources.

LARF-3 provided financial support for three annual rounds of LARF research project submissions. The assessment of LARF project submissions was made by an evaluation committee within the National Agriculture and Forestry Research Institute (NAFRI). This evaluation committee was comprised of representatives from NAFRI, the National University of Laos (NUOL), the Lao National Agricultural Extension Agency, and The University of Queensland (UQ). Between 25 and 40 submissions were received for funding consideration in each year of the 3-year project. A total of 19 individual research projects were conducted over the three year period (January 2015 – December 2017) and a total of 121 310 USD was awarded to Lao researchers. All research activities were coordinated through NAFRI within the Ministry of Agriculture and Forestry (MAF). The projects for which LARF funding support was approved were distributed across eight different research organisations (including the universities in the provinces of Luang Prabang, Savannakhet and Champassak).

An important component of this program has been the requirement for sharing of research output with institutions and research personnel within Laos. Dissemination of research output is through the publication of research papers in the Lao/NAFRI Journal of Agriculture and Forestry (which is accessible on the NAFRI website: [www.nafri.org.la](http://www.nafri.org.la)). In recent years, the focus has moved from publishing in English (with Lao abstracts), to publishing in Lao (with English abstracts). The objective of the increased focus on the use of the Lao language was to help enable the greater sharing of the research output in a form that is more readily accessible by researchers, extension officers and policy makers within Lao PDR, particularly for personnel in provincial locations. LARF-3 included provision for publication support for one of the two issues of the Lao journal that are published annually. Over the three-year period of LARF-3, 28 research papers based on the research output of LARF supported research have been published, or are scheduled to be published in July 2018. To assist authors in drafting research papers for publication in the Lao Journal of Agriculture and Forestry, a series of technical writing skills training courses, led by recognised Lao research leaders, were conducted on an annual basis for project leaders.

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<sup>1</sup> <http://aciarc.gov.au/project/ase/2006/060>

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## 3 Background

Agriculture remains a major sector of the economy of Laos, contributing approximately 30% of the GDP. The agricultural sector of Laos is dominated by subsistence farming, with rice being the dominant crop.

The GoL recognises the need for ‘modernisation of the agricultural sector in a manner that fully meets sustainable practices and achieves food security and better livelihoods for all Lao people as a top priority for agricultural development’. ‘Vision 2020’ for Lao PDR for agricultural development anticipates increasing the production of the agriculture and forestry sectors through ‘an increased focus on the utilisation of the country’s rich natural resources and existing potential, along with natural environmental conservation. The vision includes seven priority program areas, one of which is strengthening the Ministry of Agriculture and Forestry (MAF), as well as local institutions, with respect to applied research and extension.

As part of the strategy of the Lao PDR to properly coordinate the majority of agricultural research in the country, in 1998 it consolidated all natural resource planning and management functions at the national level under NAFRI (National Agriculture and Forestry Research Institute), to strengthen national resource management systems at the national and village/community levels. The LARF-3 Project was managed and implemented, in collaboration with NAFRI.

Approximately 90% of funding for agricultural research in-country is derived from sources external to Lao PDR, mostly through large agricultural development projects which usually have specific development objectives. These projects are generally undertaken on a collaborative, high-level, institution-to-institution basis to tackle the challenges in the grander context. As such, there is very little opportunity, and thus capacity for individual agricultural research staff to develop and manage research proposals and projects in line with national agricultural research for development (R4D) priorities, particularly at the provincial and district level. Furthermore, because most funding is received from and/or managed by international development agencies and organisations, there is limited research management and administration capacity within the research institutions of the GoL.

LARF-3 aimed to provide Lao scientists with opportunities to access and compete for funds for agricultural research. In addition to improving the research capacity of Lao researchers and Lao research institutions, the project also aimed to improve the capacity of researchers and their respective agencies, to get further research and development funding support from a range of donor sources.

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## 4 Objectives

The primary objective of LARF-3 has been the delivery of a collaborative and competitive grant scheme for agricultural research in Lao PDR that could also assist in improving the research capacity of Lao research staff and their institutions. The specific objectives of LARF-3, as defined in the original project proposal, were:

1. To enhance the research management capacity of Lao research organisations;
2. To develop the capabilities of Lao researchers to undertake and report independent research;
3. To improve research links and collaboration between research organization within Laos; and,
4. To increase external funding access for local research organisations in Laos.

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### 4.1 To enhance the research management capacity of Laos organisations

A major objective of LARF-3 was the improvement of Lao research management capabilities for assessing research proposals for consistency with national research and development priorities and objectives. With the majority of research funding support for Laos coming in the form of bilateral and international donor funding, the assessment of research projects is usually done on the basis of strong donor inputs and guidance. Although there is usually strong collaboration with the main Lao research agencies, such as NAFRI, in approving research initiatives, these initiatives are usually based on 'guidelines of the donor'. Where ACIAR projects are already formulated on a basis of strong Lao inputs, LARF-3 was based on a strong role of NAFRI and other Lao research institutions, in assessing whether project proposals conform to national research and development priorities and in assessing research output.

The mission of NAFRI is to: (i) carry out integrated 'research for development' to overcome specific problems which are limiting for agricultural production, cause degradation of natural resources, agro-biodiversity and climate change; (ii) strengthen research culture, capability building and research collaboration; and, (iii) develop effective communication and information systems, so that a range of actors have better access to information and knowledge at the national level. The in-country coordination of LARF-3 was conducted by NARFI to: (i) enhance in-house capability with respect to research management and administration; (ii) ensure that all research proposals and subsequent projects conformed to national R4D priorities; and, (iii) improve the reputation of NAFRI and other GoL departments as a professional research organisations at the institutional level.

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### 4.2 To develop the capabilities of Lao researchers to undertake and report independent research

LARF-3 provided Lao scientists with opportunities to access and compete for funds for agricultural research in order to build individual researchers' capacity to develop research proposals and manage small research projects. This aimed to build individual capacity of research and technical staff in proposal development, statistical analysis and interpretation, data visualisation and technical and financial reporting. The Project also aimed to improve Lao researchers' research and reporting skills through support for training on research proposal development, technical writing skills, and research statistics. In addition to improving the research capacity of Lao researchers and their institutions, this approach was also expected to improve the capacity of Lao researchers and their



institutes to get further research and development funding support from a range of donor sources.

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### **4.3 To improve research links and collaboration between organisations in Laos**

Through the in-country coordination of LARF-3 by NAFRI, it was intended that collaboration between research organisations in-country would be enhanced. The development of LARF-3 projects aimed to foster research links between central research units and provincial departments of agriculture and forestry, through: (i) the requirement in most LARF supported projects implemented in the provinces to have strong collaborative links with appropriate personnel at provincial level; (ii) recommendations that provincial LARF initiatives be linked with centrally based/national institutions, to ensure that proposed LARF research projects fit into national research and development priorities.

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### **4.4 To increase external research funding accessible by research organisations in Laos**

It is recognised that the capacity of Lao research institutions, such as NAFRI and NUOL to access external funding, is limited by both an ability to develop research proposals which might be potentially attractive to donors, as well as an awareness of potential donor funding sources. The institutionalisation of LARF within NAFRI, together with the proposed training initiatives within the context of LARF, aimed to help with the development of Lao capabilities in both these areas. Therefore, this objective was to provide Lao agricultural researchers and institutions with the appropriate skills and experience to, ultimately, competitively apply for research funds from a range of funding agencies external to the GoL.

## 5 Methodology

### 5.1 Focal regions

The focal areas of the LARF-3 program were located in the lower central, southern, and northern agricultural regions of Laos, with a specific focus on the provinces of Savannakhet, Champasak and Luang Prabang (see Figure 1)

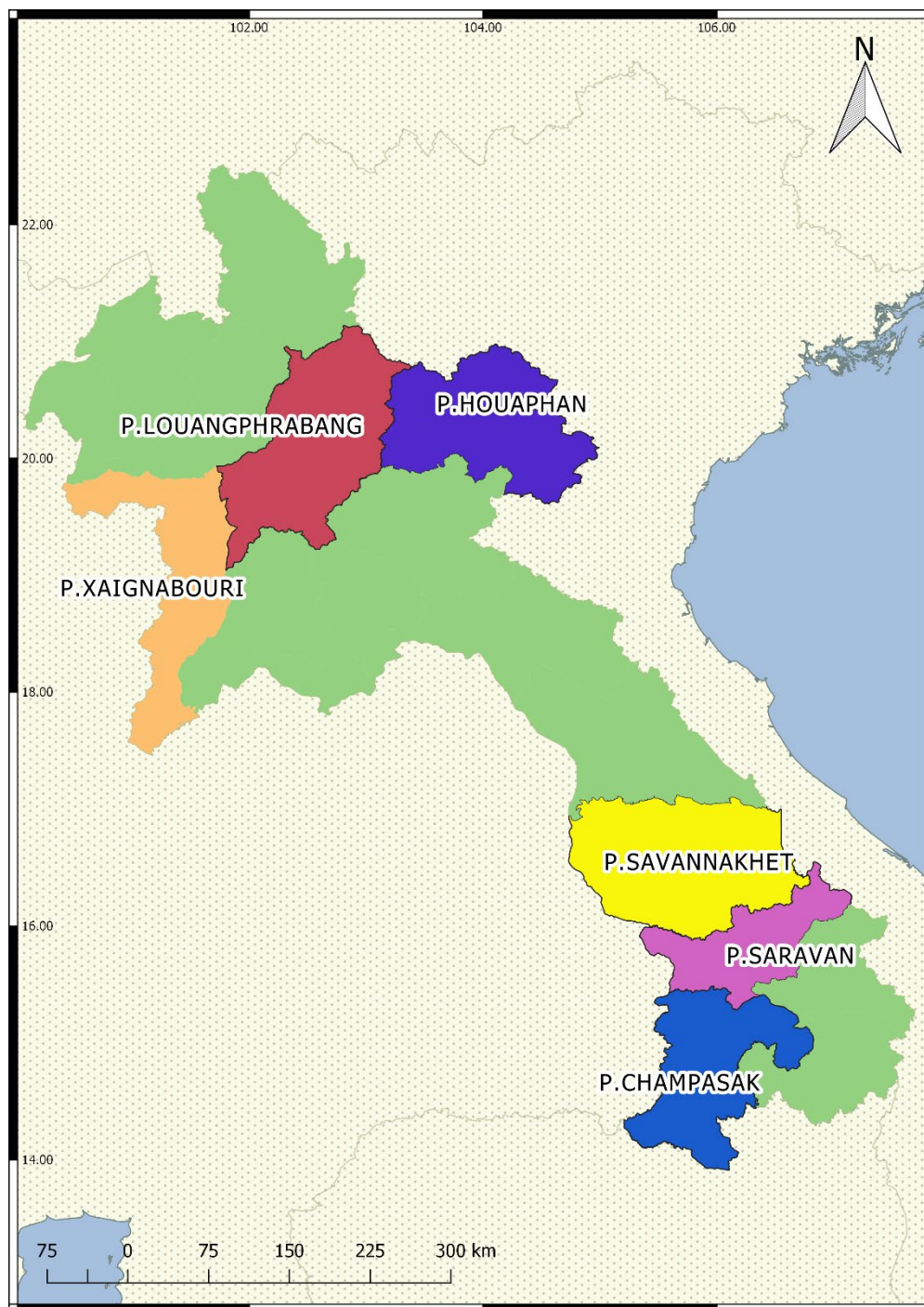


Figure 1. Provinces of Laos where LARF-3-funded projects were located

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## **5.2 Improved research management capacity of Lao research organisations**

A research framework was clearly identified during the design phase of program (see Appendix 11.1). This included the formation of a management committee and assessment panel limited to representatives from NAFRI, the National University of Laos (NUOL), the Department of Agricultural Extension and Cooperatives (DAEC), and The University of Queensland (UQ).

The management committee and assessment panel ensured that all research projects conformed to national R4D priorities - predetermined through consultation with provincial university leaders in Champasak, Savannakhet and Luang Prabang. Additionally, the committee were required to develop a comprehensive grant application package and robust selection criteria to ensure integrity of the proposed research, of the selection process and competitiveness in order to improve the reputation of NAFRI and other GoL departments as professional research organisations.

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## **5.3 Improved capacity of Lao researchers to undertake and report independent research**

The LARF-3 grant scheme was open to Government of the Lao (GoL) research agencies and universities based in the Lao PDR, which have a mandate to undertake agricultural research. LARF-3 provided financial support for three annual rounds of LARF research project submissions. Proposals were required to contain a defined research project, and could be of one or two years in duration. The annual funding limit for individual projects was US\$6,000 and a maximum of US\$10,000 for two-year projects. The LARF grant funding was for expenditure only within the Lao PDR.

Projects were considered in the areas that complement ACIAR's support for the government of the Lao PDR in its agricultural development objectives relating to the Northern and Southern Agricultural Regions of Lao PDR in relation to: (i) Improving the productivity of lowland farming systems; (ii) Development alternatives to shifting cultivation in upland regions; (iii) Assisting with adaptation to climate change at farm level through more efficient use of soil and water resources. Within the context of these broad guidelines, project proposals were considered in the following areas:

- Crop production (including horticultural crops), plant protection and post-harvest technologies;
- Livestock production and livestock health;
- Forestry research;
- Natural resource management, as it relates to sustainable agricultural production;
- Integrated agricultural systems research
- Fisheries research.

Preference was given to proposals that:

- Had clear potential benefits to smallholder producers or to the broader community;
- Incorporate a farmer-participatory research approach;
- Involve collaboration between different agencies;
- Include some complementary inputs from other sources.

All projects were required to be led and implemented by Lao scientists.

To improve individual research capacity, a suite of training workshops was delivered by senior Lao researchers during each funding round of LARF-3. Topics included: research proposal development; experimental design; and, technical writing skills. All researchers were also required to present their findings through oral presentations at various seminars

and workshops; and, as a manuscript which has been, or is due to be included in the Lao Journal of Agriculture and Forestry. For a full list of papers, see Section 10.2.

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## **5.4 Improved research links and collaborations between research organisations in Laos**

Collaborative links between NAFRI, Universities and other GoL agencies were improved through the undertaking of applied research, particularly in regional (provincial) areas. Collaborative links between other organisations and NAFRI were enhanced through the mentoring roles of NAFRI researchers on LARF-3 funded projects.

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## **5.5 Increase accessibility of external research funding research organisations in Laos**

A NAFRI ICT specialist was enlisted to develop a strategy to regularly monitor external funding opportunities posted on the internet or from other sources. Once identified, opportunities were posted on the NAFRI website.

## 6 Achievements against activities and outputs/milestones

### 6.1.1.1 Objective 1: To enhance the research management capacity of Lao research organisations

no.	activity	outputs/ milestones	completion date	comments
1.1	Develop the managerial capacity to initiate and coordinate research	<p>Enhancement of capacity of NAFRI to independently formulate, coordinate and implement objectives consistent with national research objectives</p> <p>Development of LARF-3 Research Framework document, to provide context for LARF-3 research proposal development and their management (includes research priorities, criteria and process for selection, consideration of gender, criteria and process for M&amp;E, communication requirements, impact path processes)</p>	<p>Complete</p> <p>Document within 3 months of LARF-3 sign-off; with on-going adaptive finessing through lessons learnt during Research Framework's implementation.</p>	<p>Earlier phases of LARF (LARF1 and LARF2) helped with the development of NAFRI research development and coordination capacity. The implementation of LARF-3 is further developing this capacity</p> <p>ACIAR funding support for this initiative was scheduled but was later overlooked in the LARF-3 budget.</p> <p>NAFRI and MAF have pre-defined applied research priorities within which LARF was expected to operate, therefore, an understanding with ACIAR has been reached and it was deemed unnecessary to develop a separate document for LARF-3.</p>
1.2		Enhancement of collaborative links between NAFRI, NGO's and other agencies in the implementation of applied research, particularly in regional/provincial locations	Complete	LARF-3 with its focus on applied research in the northern and southern agricultural regions of Laos helped expand the collaborative links with regional universities.
1.3		Enhancement of capacity of NAFRI to evaluate research objectives and research output, relative to national agricultural development objectives	Complete	Continual development of research management and administration as the initiative progressed.

no.	activity	outputs/ milestones	completion date	comments
1.4		Enhancement of the capacity of NAFRI to seek research funding sources, independent of larger development programs	Ongoing throughout LARF-3	Some researchers applied for MEKARN for their PhD studies such as Mr. Sangkhom, Ms Noupone, at Souphannouvong Universities: Dr. Phonepaseuth and Ammaly at NAFRI applied research proposal for IFAD, ACIAR support fund.
1.5		Enhancement of collaborative links between other organisations and NAFRI through the mentoring roles that are expected to development when funding is available for research	Ongoing throughout LARF-3	NAFRI researchers provided mentoring role for the researchers who have been working at different research agencies such as Champasack, Savannakhet and Souphannouvong Universities universities and provincial agriculture offices.

PC = partner country, A = Australia

#### 6.1.1.2 Objective 2: To develop the capabilities of Lao researchers to undertake and report independent research

no.	activity	outputs/ milestones	completion date	comments
2.1	Develop research proposals for potential LARF-3 support which are consistent with national research and development priorities	A range of proposals will be developed for LARF-3 funding consideration; these proposals will be consistent with Lao national research and development priorities	April 2015  March 2016  March 2017	28 research proposals were submitted for LARF funding consideration; 5 projects were approved for support, involving total funding of USD 33 000  25 research proposals were submitted for funding consideration; 7 proposals were approved for support, involving total funding of USD 42 000  32 research proposals were submitted for funding consideration, 8 proposals were approved for support, involving total funding of USD 45 920
2.2		Enhanced capability of individual Lao researchers to develop, defend and implement agricultural research proposals	Complete	With the focus being applied research in the southern and northern agricultural regions, institutions and potential LARF-funded project leaders were encouraged to establish links with research leaders at the national level (NAFRI and other institutions in Vientiane) for advisory inputs by recognised research leaders in national institutions



no.	activity	outputs/ milestones	completion date	comments
2.3		Enhancement of opportunities for Lao researchers in regional and provincial locations, to access research funding and implement research initiatives with specific relevance to regional problems	Complete	Visits to provincial and regional Institutions were arranged at least twice annually, to outline the procedures for LARF project assessment and to provide opportunities for discussion of project concept notes. During the discussions, links were also recommended with specific research leaders in Laos who could help with the development of research proposals, as well as providing advice during the implementation of LARF projects
2.4	Conduct training courses aimed at improving research analytical and reporting skills	Development of research proposals of high quality  Writing and publication (in the Lao Journal of Agriculture and Forestry) of research papers of high quality	Complete  Due for completion approx. July 2018	As part of the process of developing research proposals, potential LARF research leaders were encouraged to develop project concept for discussion with research leaders, before formulating and submitting detailed project submissions  It is a requirement of all LARF project leaders that they share their research output through the writing of LARF based research papers for publication in the Lao Journal of Agriculture and Forestry. LARF-3 provided support for annual technical writing skills training courses to facilitate this reporting requirement and to improve the technical writing skills of training course participants. Writing skills training courses were held in Mar 2016, Feb – Mar 2017 and Feb – Mar 2018. The final papers will be published in the Lao Journal of Agriculture and Forestry No. 38 (Jan – June 2018).

PC = partner country, A = Australia

### 6.1.1.3 Objective 3: To improve research links and collaboration between research organization within Laos

no.	activity	outputs/ milestones	completion date	comments
3.1	Enhancement of role of NAFRI in assessing LARF research proposals from NAFRI and other institutions within Laos, confirm with national research priorities	Endorsement of funding support for LARF projects that meet national research and development priorities	Complete	The listing of LARF projects which were endorsed for funding support was made on the NAFRI website, including the objectives summaries for each LARF project. Guidelines for LARF project assessment and application forms for LARF project funding submissions were also listed on the NAFRI website.

no.	activity	outputs/ milestones	completion date	comments
3.2	Enhancement of perception of the importance of NAFRI in research coordination and assessment roles, among institutions external to NAFRI	Annual submission of LARF research proposals by institutions external to NAFRI	Complete – Annual endorsements were made in April 2015, 2016 and 2017	The role and importance of NAFRI in national agricultural research initiatives (including LARF) is increasingly referred to on the NAFRI website <sup>2</sup> (or those managed by NAFRI e.g. (Lao Agriculture and Forestry Database <sup>3</sup> ). NAFRI websites also provide access to all issues of the Lao Journal of Agriculture and Forestry, in which LARF project output is published.

#### 6.1.1.4 Objective 4: To increase external funding access for local research organisations in Laos

no.	activity	outputs/ milestones	completion date	comments
4.1	Increasing the awareness of quality agricultural research output in Laos	Publication and sharing of research output from LARF and other research funding agencies/donors	Ongoing throughout the life of the project and the publication of the Lao Journal of Agriculture and Forestry at 6 month intervals	<p>The Lao Journal of Agriculture and Forestry published by NAFRI is the recognised national journal of agriculture and forestry within Laos. The journal is published at 6 month intervals, with each issue being accessible on the NAFRI website. To assist in making the research output available in a form that meets the needs of potential readers throughout Laos, the focus of research articles published in the Lao journal has moved from English to the Lao language (with English abstracts).</p> <p>LARF provides support for the sharing of research through the budget provision for the publication of one of the two issues of the journal published annually, and through support for an annual Technical Writing Skills Training Course</p>
4.2	Defining and sharing of applied research priorities of NAFRI/MAF	Publication (in Lao and English) and distribution of regional/provincial applied research	<p>February 2015 – Availability of initial LARF supported output defining regional applied research priorities</p> <p>Updating of the applied research priorities on an annual basis throughout the life of LARF-3</p>	<p>ACIAR indicated that funding would be made available within the LARF budget for this activity. However, no specific funding was made available for this recommendation (from ACIAR) in the final LARF budget</p> <p>As NAFRI has already documented the national applied research priorities of NAFRI/MAF, it was agreed (with both ACIAR and NAFRI) that there was no need for this recommendation to be implemented and therefore no need for ACIAR to provide additional funding support for this within the context of the LARF-3 budget</p>

\* LARF project numbering is based on the number of projects supported since the start of LARF in 2007.

<sup>2</sup> <http://www.nafri.org.la>

<sup>3</sup> <http://lad.nafri.org.la>



## 7 Key results and discussion

### 7.1 Projects funded through LARF-3

For each of the three funding phases of LARF-3, between 25 and 32 proposals were received; and a total of 19 projects were supported. A full list of projects, principal investigators (PIs), affiliations, project duration and funding received is given in Table 2.

As shown, the total amount of funding dispersed was 121 310 USD amongst eight different GoL research organisations which, for the first time, included the major provincial universities located in Luang Prabang, Savannakhet and Champasak. Note that there were no principal investigators (PI's) or named collaborators external to GoL research organisations listed in the successfully funded projects.

As part of the process of helping with the development of research institutions in the northern and southern regions, NAFRI decided that proposals should include appropriate technical advisors from within NAFRI. The adoption of this approach intended to help in the development of long-term collaborative working relationships between NAFRI and the provincial organisations, while also ensuring that the research proposals submitted by provincial organisations conform to the national agricultural development priorities. The involvement of NAFRI advisors also assisted in the process of human resource development of provincial researchers in research planning, implementation, analysis and reporting (the writing of LARF based technical research papers for publication in the Lao Journal of Agriculture and Forestry). The LARF link with NAFRI also complimented the recent establishment of a National Research Council within NAFRI.

Across the board, the biophysical aspects of agricultural production was the main focus with livestock-related topics featuring heavily (12/19 projects); only 1/19 projects featured an element of the economic impact on smallholder household income (see *Cassava intercropping with legume crops in mountainous areas and the effects on the yields of cassava and legume crops, and farmer's income in Xayabouly province*). There were also very few female PI's (1/19 projects).

### 7.2 Building individual research capacity in Laos

The LARF research funding project has significantly contributed to building research capacity of Lao researchers in agricultural disciplines, particularly within the GoL national agriculture and forestry research institution (NAFRI), but also in a number of other organisations, including universities and provincial departments of agriculture and forestry. This has been achieved by a combination of mentoring of research and formal and informal training initiatives coordinated through LARF (see Table 1).

In the previous phases of LARF, research statistics workshops were also conducted by researchers from the Faculty of Agriculture, Khon Kaen University in Thailand. However, due to funding constraints, these workshops could not be held.

**Table 1: Details of informal and formal training sessions conducted during LARF-3**

Activity	Purpose
<b>Research proposal development</b>	Training in this area was provided on a 'one-to-one' basis. With the increased awareness of LARF, opportunities were provided for potential project leaders to submit 'project concepts' for discussion and comment (comment being provided by members of the LARF panel, as well as from other independent sources), before the development and submission

	<p>of full project proposals. Advice was provided on the further development of individual proposals when it was considered that the 'project concept' meets LARF guidelines and had an opportunity of receiving LARF funding support. Where possible, mentoring links were established between proposed project leaders and 'specialists' in the subject of the proposed project (some of these mentoring links are with research specialists involved with other ACIAR supported projects).</p>
<p><b>Technical Writing Skills Training</b></p>	<p>A Technical Writing Skills Training Course was conducted during each funding phase of LARF-3 (28 – 31 Mar 2016; 27 Feb – 02 Mar 2018). All PI's who have received LARF funding were required to attend these workshops to assist in the preparation of manuscripts to be published in the Lao Journal of Agriculture and Forestry. Instructors for these courses were, for the most part, recognised NAFRI research leaders together with representatives of the Information and Communication Technology (ICT) department of NAFRI. In 2016 and 2017, there were a total of 17 participants. As part of the writing skills training course conducted in 2017, the opportunity was provided for LARF project leaders to make presentations of their project outputs. These presentations were open for general attendance by anyone interested in the research topics.</p>



**Figure 2. Presentation of research findings and technical writing workshop, 27 February 2017, NAFRI, Vientiane (source: C. Vote 2018)**

In addition to the general business of research development, design and reporting, the PI's were required to present their findings to their peers during the workshops, including the technical writing workshops that were conducted during each funding phase (see Figure 1). All PI's were required to write up the results of their work to be published in the Lao Journal of Agriculture and Forestry.

The recent focus on writing these papers in the Lao language has also increased the visibility of the research with other researchers and policy makers in Laos. These papers are also accessible the NAFRI website (and some also on the ACIAR website<sup>4</sup>, for ACIAR-supported publications), has also helped in giving Lao researchers a greater incentive to publish their research output. The publication of research output has also been facilitated by appropriate training support.

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### **7.3 Improved institutional research management and administration capability**

Since its inception in 2005, LARF has assisted the main Lao coordinating agency, NAFRI, in the development of the required management skills for project proposal evaluation and project monitoring. Improved research management and administration capacity at the institutional level has been achieved by NAFRI through its' responsible financial management of a research funding pool; assessment of proposals in line with national priorities (identified by a management committee in consultation a cohort of key stakeholders comprised of local and international experts from within the GoL and external organisations); and improved monitoring and evaluation of the overarching program as well as individual research project outputs to determine the scientific contribution and the potential impact that it may have for the smallholders in Laos.

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### **7.4 Improved research links and collaboration between various organisations in Laos**

Improved research links and greater collaboration were fostered through the invitation of key GoL researchers within the different organisations to: assist in the identification of regional-specific research themes and priorities; the development of selection criteria; and the assessment of grant applications.

Projects supported by LARF have also helped in the development of research links between central research units and provincial departments of agriculture and forestry, through: (i) the requirement of most projects implemented in the provinces to have strong collaborative links with appropriate personnel at provincial level; (ii) recommendations that provincial LARF initiatives be linked with centrally based/national institutions, to ensure that proposed LARF research projects fit into national research and development priorities. Collaborative research links have also been developed between NAFRI and the Faculties of Agriculture and Environment in key universities within Laos.

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<sup>4</sup> <http://aciarc.gov.au/publication/latest>

**Table 2: List of all projects funded through LARF-3 (2015 – 2018)**

Project Title	Principal Investigator	Affiliation	Project Duration	Project Budget (USD)	Collaborating Organisations
<b>2015</b>					
Comparison of fertiliser use when applied by direct seeder versus broadcast application after germination (LARF-62)	Mr Sysavanh Vorlasan, Savannakhet,	PAFO, Savannakhet Province	12 months	6000	NAFRI, Vientiane; Provincial Agriculture and Forestry Office, Savannakhet Province; District Agriculture and Forestry Office, Champhone District, Savannakhet
Bitter Neem ( <i>Azadirachta indica</i> ) as a new alternative foliage for animal health for rural farmers in Northern Laos (LARF-63)	Mr Sangkhom Inthapanya	Souphanovong University, Luang Prabang	12 months	6000	Department of Livestock & Fishery, Faculty of Agriculture, Nabong campus, Vientiane province; Livestock and Fishery Section, Provincial Agriculture and Forestry Office, Luang Prabang Province; Agriculture Technique Centre, Agriculture & Forestry Office, Phonexay district, Luang Prabang
Legume ( <i>Stylosanthes guianensis</i> CIAT 184) and <i>Aeschynomene histrix</i> cv BRA 9690) leaf meal as protein source in smallholder pig production in Hua Muang district, Huaphan province (LARF-64)	Mr Keo Xaiphengphan	LRC (NAFRI)	12 months	5500	District Agriculture and Forestry Office, Hua Muang district, Houaphanh province; District Agriculture and Forestry Office, Hua Muang district, Huaphanh province
Technology development for offseason lime production in Champassak Province (LARF-65)	Mr Phaythoune Mounsena	Horticulture Research Center (HRC) NAFRI	24 months	10 000	Champassak University, Faculty of Agriculture and Forestry; Provincial Agriculture and Forestry Office, Champassak Province; District Agriculture and Forestry Office, Prathumphone District, Champassak Province

Project Title	Principal Investigator	Affiliation	Project Duration	Project Budget (USD)	Collaborating Organisations
Effect of fermented cassava pulp as a main source of energy with supplements of <i>Muntingia</i> ( <i>Muntingia calabura</i> ), mimosa ( <i>M. pigra</i> ) and cassava foliage on growth performance of local goats (LARF-66)	Mr Souksakhone Vivasane	Livestock Department, Champasak University, Champasak Province	12 months	6000	Plant Health Section, Department of Agronomy, MAF, Vientiane; Department of Livestock and Fisheries, Ministry of Agriculture and Fishery, MAF, Vientiane; Livestock Research Center, NAFRI, Vientiane
<b>2016</b>					
Improving local pig breed (Moo Lat pigs) reproduction in PDR by using the Vietnamese pig breed Mong cai in Luang Prabang Province (LARF-67)/ (LARF-80)	Ms Nouphe Manivanh	Faculty of Agriculture and Forestry, Souphanovong University, Luang Prabang	24 months	10 000	LRC (NAFRI); Livestock and Fishery Office, Luang Prabang Province; Animal Science Department, Faculty of Agriculture and Forestry Resources, Souphanouvong University, Luang Prabang
<i>Tinospora crispa</i> and Neem as an alternative for control of internal parasites of pigs of smallholder farmers in Luang Prabang province (LARF-68)	Mr Somphanh Bounyavong	Faculty of Agriculture and Forestry Resources, Souphanovong University, Luang Prabang	12 months	6000	Department of Livestock & Fisheries, Faculty of Agriculture, Nabong Campus, Vientiane Capital; Livestock and Fishery Section, Agriculture and Forestry Office, Luang Prabang Province; Agriculture & Forestry Office, Pakxaeng District, Luang Prabang Province.
Effects of replacement of ground maize with dried cassava and <i>Stylosanthes</i> (CIAT 184) for improving pig production in the uplands of Northern Laos (LARF-69)	Mr Ouanh Phomvisith	Provincial Agriculture and Forestry Office (PAFO), Houaphanh Province	12 months	6000	Planning and Cooperation Division, NAFRI, Vientiane; Agricultural Extension and Cooperative Section (PAFO), Houaphanh Province; Sobhao Agriculture Technical Service Center, Houaphanh Province; Sobhao District Agriculture and Forestry Office, Houaphanh Province

Project Title	Principal Investigator	Affiliation	Project Duration	Project Budget (USD)	Collaborating Organisations
Use of ensiled <i>Leucaena leucocephala</i> to improve smallholder goat production in Xayphouthong district, Savannakhet province (LARF-70)	Mr Outhen Phommascak	Faculty of Food Sciences, Savannakhet University, Savannakhet Province	12 months	5890	Livestock Research Center (NAFRI), Vientiane; Provincial Livestock and Fisheries Office, Savannakhet Province; District Livestock and Fisheries Office, Xayphouthong district, Savannakhet province
Cassava intercropping with legume crops in mountainous areas and the effects on the yields of cassava and legume crops, and farmer's income in Xayabouly province (LARF-71)	Mr Phathasin Khamthavong	Agriculture Research Center, ARC (NAFRI)	12 months	6000	International Center for Tropical Agriculture (CIAT); Kheanthao District Agriculture and Forestry Office (DAFO), Sayabouly Province.
Study of yield and yield components of soybean varieties on the Bolaven Plateau, Champasak province (LARF-72)	Dr Siviengkhek Phommalath	Agriculture Research Center, ARC (NAFRI)	12 months	6000	Champassak University, Champassak Province; District of Agriculture and Forestry Office, Bachiengchalernsouk district Champassak province
Reproduction of <i>Hemibagrus wychiodes</i> (Pakeung) and grow-out trials with cages in ponds. (LARF-73)	Mr Sompanh Philavong	Living Aquatic Resources Center LARReC (NAFRI)	12 months	6000	Champassak Provincial Livestock and Fisheries Office; Khong District Livestock and Fisheries Office
<b>2017</b>					
Assessment of the effect of nitrogen source on maize yield in Xayabouly Province (LARF-74)	Mr Saythong Oudthachit	MCCRC (NAFRI)	12 months	6000	DAFO, Paklay District, Xayabouly Province
Improvement in goat productivity by smallholder farmers in Savannakhet Province (LARF-75)	Mr Phoukham Viengvilay	LRC (NAFRI)	12 months	6000	DAFO, Phin District, Savannakhet Province

Project Title	Principal Investigator	Affiliation	Project Duration	Project Budget (USD)	Collaborating Organisations
Parasite control for local goats fed cassava foliage and Ivermectine treatment in smallholder production systems (LARF-76)	Mr Somchanh Khamphavong	LRC (NAFRI)	12 months	5920	DAFO, Chomphet District, Luang Prabang Province
On-farm reproduction of <i>Hemibagrus filamentus</i> , and growing-out trial of <i>H. filamentus</i> using cages in ponds in Salavan province. (LARF-77)	Mr Oulaytham Lasasimma	FRC (NAFRI)	12 months	6000	PAFO, Salavan Province; Nong Deng Aquaculture Research Center, Vapee District, Salavan Province
Increasing the nutritional value of animal feed resources and income generation of smallholder farmers through the introduction of intensive cattle fattening in Northern Laos (LARF-78)	Mr Sangkhom Inthapanya	Faculty of Agriculture and Forestry, Souphanovong University, Luang Prabang	12 months	6000	LRC (NAFRI); Livestock and Fishery Section, Luang Prabang; Luang Prabang Agriculture and Forestry Department
Protein enrichment of cassava and corn using local yeast, for smallholder pig production in Luang Prabang Province (LARF-79)	Dr Vongpasith Chanthakhoun	Faculty of Agriculture and Forestry, Souphanovong University, Luang Prabang	12 months	6000	N/A
Improvement of low chicken productivity in Xayphouthong district, Savannakhet province (LARF-81)	Mr Outhen Phommasack	Research and Postgraduate Office, Savannakhet University	12 months	6000	LRC (NAFRI); PAFO Livestock and Fisheries, Savannakhet Province; DAFO, Xayphouthong district, Savannakhet Province

**Total amount of funding received (USD)**

**121 310**

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## 8 Impacts

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### 8.1 Scientific impacts – now and in 5 years

Apart from the short-term research output on the completion of LARF-3 projects, the most important impact of the LARF initiative is the role it has had in fostering greater collaboration between central and provincial/district GoL researchers in Laos.

LARF-3 was focused on applied research in the southern and northern agricultural areas of Laos, the focus being a joint decision of ACIAR and NAFRI. As most of the LARF-3 supported projects were implemented by researchers based in the provinces of the northern and southern agricultural regions, the project assisted in the development of strong collaborative links between the central research agencies (e.g. NAFRI) and the regional/provincial research agencies, including the universities based in the northern and southern regions of Laos. This linkage will serve to foster greater collaboration between central and provincial/district researchers into the future.

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### 8.2 Capacity impacts – now and in 5 years

Increased research capacity of individual Lao researchers was achieved through the development of skills related to project proposal development, experimental design, data analysis and interpretation, budgetary management and scientific and financial reporting.

The LARF initiative is one of the few bilaterally-funded programs where research proposals were developed directly, and solely, by Lao researchers and institutions (with the exception of the Australian Project Leader, Dr John Schiller, who provided mentorship to all PI's and prospective PI's). LARF also provided the main Lao coordinating agency, NAFRI, a vehicle to develop the required management skills for project proposal evaluation and project monitoring. Related training initiatives also helped to develop research and technical skills of individual PI's.

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### 8.3 Community impacts – now and in 5 years

#### 8.3.1 Economic impacts

Individual project proposals which involved a farmer participatory research approach and had greater long-term potential to increase economic benefits to smallholder agricultural producers in rural Laos selected for funding support. The potential economic benefits from individual projects will be able to be better defined as the research output from projects become available, distributed via NAFRI website in the Lao language.

#### 8.3.2 Social impacts

Guidelines for research proposals to be funded specifically stipulated that preference is given to *'projects which have clear potential benefits for smallholder producers or to the broader Lao rural community'*. Most projects approved for funding support were based on a 'farmer participatory research approach' which involved farmer and community meetings in the various stages of project planning and project implementation. These activities were also undertaken in collaboration with representatives of the District Agriculture and Forestry Offices (DAFO) within the Provincial Agriculture and Forestry Offices of specific provinces. LARF project outcomes were shared with officials and farming communities through the production of extension advisories in the form of posters upon completion of projects.



### 8.3.3 Environmental impacts

Projects supported by the LARF initiative were only those that had the potential to contribute to sustainable agricultural production without adverse environmental effects.

## 8.4 Communication and dissemination activities

An important component of this program has been the requirement for sharing of research output with institutions and research personnel within Laos. Dissemination of research output is through the publication of research papers in the Lao/NAFRI Journal of Agriculture and Forestry (which is accessible on the NAFRI website: [www.nafri.org.la](http://www.nafri.org.la)). In LARF-3, the focus moved from publishing in English (with Lao abstracts), to publishing in Lao (with English abstracts). The objective of the increased focus on the use of the Lao language was to help enable the greater sharing of the research output in a form that is more readily accessible by researchers, extension officers and policy makers within Lao PDR, particularly for personnel in provincial locations. LARF-3 included provision for publication support for one of the two issues of the Lao journal that are published annually.

Over the three-year period of LARF-3, 28 research papers based on the research output of LARF supported research have been published, or are scheduled to be published in July 2018. For a full list of publications, see Section 10.1.



Figure 3. Volume 34 (January - June 2016) and Volume 36 (January – June 2017) of the LARF-3 supported The Lao Journal of Agriculture and Forestry.

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## **9 Conclusions and recommendations**

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### **9.1 Conclusions**

Nineteen projects funded through the LARF-3 initiative with a combined total of 121 310 USD were conducted between 2015 – 2017. As a result, 28 research papers have been, or are soon to be published in the Lao Journal of Agriculture and Forestry. Through this initiative, individual research capacity has been enhanced and the continued administration of this competitive grant scheme through NAFRI has strengthened institutional research management and administration capacity.

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### **9.2 Recommendations**

1. A greater number of Lao female researchers should be encouraged to apply for funding to improve the gender balance in line with the ACIAR equity policy strategy 2017 – 2027.
2. A greater effort to promote links and collaborations between GoL research institutions and external organisations should be made.
3. Innovative ways (other than simply posting information on the NAFRI website) of communicating calls for proposals and disseminating research outputs should be explored.

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## 10 References

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### 10.1 List of publications produced by project

Twenty-eight research papers have directly resulted from LARF activities and have published, or are soon to be published, in the Lao Journal of Agriculture and Forestry (Volume 34 in 2016; Volume 36 in 2017), or scheduled for publication in Volume 38 in 2018, are listed below. Note that several of the papers published in 2016/17 were research outputs from earlier phases of LARF (specifically, LARF2). The journal and all individual research papers can be accessed on the NAFRI website<sup>5</sup>.

#### 10.1.1 Journal of Agriculture and Forestry No. 34 (Jan-June 2016)

1. *Selection of Frog Species*. Bounsong Vongvichit and Phoneraphet Chanthasone. Lao Journal of Agriculture and Forestry No. 34 (Jan-June 2016). pp. 46-57.
2. *Smallholder fish production in Kaisonphomvihan District, Savannakhet Province*. Souksakhone Phengsekeo, Somboun Chanrya, Lumngean Phengsekeo, Sathewan Thykeo and Sitha Khemmalath. Lao Journal of Agriculture and Forestry No. 34 (Jan-June 2016). pp. 16-32.
3. *Gender role in upland farming systems – an exploratory study in Viengkham district, Luang Prabang province, Lao PDR*. Vilaphone Kanyasone, Loui Vannamaxay and Soulaseng Bounvilaysone. Lao Journal of Agriculture and Forestry No. 34 (Jan-June 2016) pp. 58-67.
4. *Assessment of the potential of direct seeding to traditional transplanting of rainfed lowland rice in Lao PDR*. Sysavanh Vorlasan, Vanthong Phengvichith, Sipaseut, Khammone Thilavong and John M. Schiller. Lao Journal of Agriculture and Forestry No 34 (Jan-June 2016). pp. 68 – 86.
5. *Nutrition improvement of Tilapia (*Orochromis niloticus*) in the Uplands of Northern Lao PDR*. Aloun Khounthongbang, Pany Sulyamat and Onchan Keovongsa. Lao Journal of Agriculture and Forestry No 34 (Jan-June 2016). pp. 98-112.
6. *Increasing pig productivity in smallholder systems through improving feed and management*. Ouanh Phomvisith, Iengkeo Xaivangmeuang, Somsana Ackhomphone, Chay Phomphet, Siphone Bounsavany and Viengsavanh Phimpachanvongsod. Lao Journal of Agriculture and Forestry No 34 (Jan-June 2016). pp. 1-15.
7. *The use of bitter neem (*Azadirachta indica*) for animal health (goats) in Northern Lao PDR*. Sangkhom Inthapanya, Sengsouly Phongpanith, Sianouvong Savathvong, Thongvanh Bountham and John M. Schiller. Lao Journal of Agriculture and Forestry No 34 (Jan-June 2016). pp. 113 – 131.

#### 10.1.2 Lao Journal of Agriculture and Forestry No 35 (July-December 2016)

8. *On-farm trial on the utilization of Stylo (*Stylosanthes guianensis* CIAT 184) as a supplement for Lao native pigs*. Keo Xaiphengphan, Phetdavan Sisanon and Phonepaseuth Phengsavanh. Lao Journal of Agriculture and Forestry No 35 (July-December 2016) pp. 22-29.

#### 10.1.3 Lao Journal of Agriculture and Forestry No 36 (Jan-June 2017)

9. *Improving the reproduction of local pigs in Northern Lao PDR based on crossing with local Vietnamese Mong cai pigs*. Noupone Manivanh, Sangkhom Inthapanya, Sianouvong Savathvong and John M. Schiller. Lao Journal of Agriculture and Forestry No 36 (Jan-June 2017) pp. 17-32.

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<sup>5</sup> [http://www.nafri.org.la/?page\\_id=179&lang=en](http://www.nafri.org.la/?page_id=179&lang=en)

10. *Assessment of the use of fermented cassava pulp supplemented with Elephant grass, Erythrina (E. subumbran), Muntingia (M. calabura) and cassava foliage, for improving the performance of local goats in Champassak province.* Souksakhone Vivasane, Toum Keopaseuth, Sounaly Somany and John M. Schiller. Lao Journal of Agriculture and Forestry No 36 (Jan-June 2017) pp. 33-50.
11. *Optimising the diet of pigs by smallholder farmers in the uplands of Northern Lao PDR.* Ouanh Phomvisith, Sitheuang Sengoukeo, Khanthong Phewvilay, Viengsavanh Phimpachanhvongsod and John M. Schiller. Lao Journal of Agriculture and Forestry No 36 (Jan-June 2017) pp. 51-67.
12. *Optimising fertilizer use efficiency in direct dry-seeded rainfed lowland rice in Lao PDR.* Sysavanh Vorlasan, Sipasaeut, Khammone Thiravong, Phetsamone Simali and John M. Schiller. Lao Journal of Agriculture and Forestry No 36 (Jan-June 2017) pp. 68-88.
13. *Assessment of Tinospora crispa and Neem (Azadirachta indica) for the control of internal parasites in pigs of smallholder farmers in Luang Prabang province.* Somphanh Bounyavong, Vannaphone Phutthana, Somvang Manotham and Somdee Sivongsod. Lao Journal of Agriculture and Forestry No 36 (Jan-June 2017) pp. 89-110.
14. *Use of dried leucaena leaf and de-worming for improving smallholder goat production in Savannakhet province.* Outhen Phommasack, Nikhom Souvannalat, Sonesana Dalaouan, Bouasavan Sonexaysithideth and John M. Schiller. Lao Journal of Agriculture and Forestry No 36 (Jan-June 2017) pp. 111-124.
15. *Evaluation of yield potential of improved soybean varieties in Champassak Province, Lao PDR.* Siviengkhek Phommala, Kongmy Simoukda, Khamphan Bounphamy, Bouakai Phommachan, Rattani Sitthikhoun and John M. Schiller. Lao Journal of Agriculture and Forestry No 36 (Jan-June 2017) pp. 125-142.

#### 10.1.4 Lao Journal of Agriculture and Forestry No 38 (Jan-June 2018)

16. *Technology development for off-season lime production.* Phaythoune Mounsena, Souvanh Thadavong, et. al. (In preparation). Lao Journal of Agriculture and Forestry No 38 (Jan-June 2018).
17. *Assessment of the agronomic and economic potential of cassava intercropping with legume cash crops in the upland cropping environment of Sayabouly province, Lao PDR.* Phanthasin Khanthavong, Somphane Hansongkham, Somsak Oulaysone and Tin Muang Aye. (In preparation). Lao Journal of Agriculture and Forestry No 38 (Jan-June 2018).
18. *Direct Dry-Seeding of Rainfed Lowland Rice in Lao PDR – A Review.* Sysavanh Vorlasan, Vongpaphane Manivong and John M. Schiller. (In preparation). Lao Journal of Agriculture and Forestry No 38 (Jan-June 2018).
19. *Reproduction of Hemibagrus wyckioides (Pa-keung) in Ban Hath Fish Indigenous Research Station, Kong district, Champasak province.* Somphanh Philavong, Bounkert Khamphithank and Khamphet Sengphachanh. (In preparation). Lao Journal of Agriculture and Forestry No 38 (Jan-June 2018).
20. *Grow-out trials with cage in ponds of Hemibagrus wyckioides (Pa-keung) in Patumphone district, Champassak Province Lao PDR.* Somphanh Philavong, Bounkert Khamphithank, and Khamphet Sengphachanh. (In preparation). Lao Journal of Agriculture and Forestry No 38 (Jan-June 2018).
21. *Improvement in goat productivity by smallholder farmers in Savannakhet province.* Authors: Phoukham Viengvilay, et al. (In preparation). Lao Journal of Agriculture and Forestry No 38 (Jan-June 2018).
22. *Parasite control in local goats using cassava foliage and Ivermectin treatment.* Somchanh Khamphavong, et. al. (In preparation). Lao Journal of Agriculture and Forestry No 38 (Jan-June 2018).
23. *On-farm reproduction of Himibagrurus filamentus in Saravan province.* Oulaytham Lasasimma, et. al. (In preparation). Lao Journal of Agriculture and Forestry No 38 (Jan-June 2018).

24. *Increasing the nutritional value of animal feed resources and income generation for smallholder cattle producers in Northern Laos.* Sangkhom Inthapanya, et. al. (In preparation). Lao Journal of Agriculture and Forestry No 38 (Jan-June 2018).
25. *Protein enrichment of cassava and corn using sources of local yeast, for smallholder pig production in Luang Prabang province.* Vongpasith Chanthakhoun, et. al. (In preparation). Lao Journal of Agriculture and Forestry No 38 (Jan-June 2018).
26. *Improvement in low chicken productivity in Xayphouthong district, Savannakhet province.* Outhen Phommasack, et. al. (In preparation). Lao Journal of Agriculture and Forestry No 38 (Jan-June 2018).
27. *Assessment of the impact of nitrogen source on maize yield in Sayabouly province.* Saythong Oudthachit, et. al. (In preparation). Lao Journal of Agriculture and Forestry No 38 (Jan-June 2018).
28. *Comparison the growth performance of different pig breeds in response to similar feeding regimes in Luang Prabang province.* Noupone Manivanh et. al. (In preparation). Lao Journal of Agriculture and Forestry No 38 (Jan-June 2018).

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## **11 Appendices**

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### **11.1 Appendix 1: Framework to determine agricultural R4D priorities for Lao PDR**

#### **11.1.1 Review National Agricultural Development Priorities for Lao PDR**

- National
- Agricultural regions
- Agricultural ecosystems (rainfed uplands, rainfed lowlands, irrigated lowlands)

#### **11.1.2 Review Agricultural Research Priorities**

- National
- Agricultural regions
- Agricultural ecosystems (uplands, rainfed lowlands, irrigated lowlands)

#### **11.1.3 Agricultural Research Priorities for Northern, Central and Southern Agricultural Regions**

- Research Priorities within the different Agricultural Ecosystems
- Categorisation of research issues within different agricultural ecosystems, within each agricultural region, for rainfed uplands, rainfed lowlands and irrigated lowland environments, into the following time-duration categories:
  - Short term (1 – 2 years)
  - Medium term (3 – 5 years)
  - Long term (> 5 years)

#### **11.1.4 Roles of National and Provincial Institutions in Coordinating and Implementing Regional/Provincial Research**

- This includes links with provincial universities and NGO's

#### **11.1.5 Research and Extension**

- Strategies for review of research output (ensuring relevance of research to farming needs)
- Strategies for transfer of research output for adoption by farming communities