Australian Government
Australian Centre for International Agricultural Research

Final report

Small research and development activity

projects	**At-Scale Evaluation of Digital Data Collection Apps (DDCAs) in ACIAR projects: Mobile Acquired Data phase 2 (MAD 2)** **Mobile Acquired Data for the Transformative Agriculture and Enterprise Development Program (MAD 4 TADEP)**
project number	GMCP/2016/004 and GMCP/2016/044
date published	
prepared by	Agricultural Impact International
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approved by	
final report number	
ISBN	

published by ACIAR
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1 Preface

This report was prepared by Agricultural Impact International Pty Ltd (AgImpact) as commissioned by the Australian Centre for International Agricultural Research (ACIAR). The information and recommendations from this study will inform ACIAR and research partners in the use of digital data collection in future research activities.

The report presents the findings of two related small research activities funded by ACIAR, being GMCP/2016/004 and GMCP/2016/044. Together these research activities provided a range of targeted technical support and institutional training across nine ACIAR research projects operating in five countries (Vietnam, Pakistan, Myanmar, Vanuatu and Papua New Guinea). Projects were supported to integrate the digital data platform CommCare into their research projects and build capacity within research institutes to amplify the benefits. Activity commenced with a Mobile Acquired Data (MAD) Masterclass in Canberra in June 2016, and concluded with a MAD Showcase in Canberra in August 2017. The project team supported all projects in-country in the period between.

AgImpact would like to thank the nine project leaders and their research teams for their time and commitment to learn CommCare, and their willingness to embrace change where project activities were already planned and had to be modified to participate in this research activity. We would also like to thank NARI management and staff for their commitment to CommCare training.

The views expressed in this report are those of Agricultural Impact International and do not reflect the views of ACIAR or the Government of Australia.

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Director, Agricultural Impact International

December 2017

2 Executive summary

The adoption of mobile acquired data (MAD) technologies can be a transformative undertaking for international agricultural research projects. However, the success of MAD adoption is highly dependent on project scope, activities, support, and (of course) management. To help understand what makes a project suitable for MAD, and how that it is successfully deployed, this report evaluates nine agricultural research projects that adopted MAD technology (CommCare) across five countries. These case studies highlight the importance of training, organisational and contextual factors in successful adoption of MAD technologies.

Suitable and well-managed MAD adoption can add significant value research projects. Research involving long and complex data collection can save significant time (up to 50%) during fieldwork, while also improving data quality. MAD technologies can provide feedback to end users (e.g. farmers) allowing better relationships with communities, and greater research impact. Digitisation of paper-based surveys provides an opportunity to renew discussions on research design. These discussions can also provide excellent opportunities to train junior scientists. The technology also allows significant capacity building in research and digital literacy of receptive partner institutions. Conversely, poorly-timed, ill-conceived and unsupported adoption can lead to loss of data, distraction from core research duties, and wasted financial resources. An evaluation of scaling methods suggests that investment in intensive training of in-country partners with management involvement can allow for the widest adoption.

Based on the case studies in this report, projects are recommended to:

1. Allow adequate planning time
2. Use MAD adoption to improve research design
3. Conduct proper testing at a site that represents conditions of actual fieldwork
4. Generate feedback loops to allow better data accuracy
5. Train enumerators for digital literacy (where necessary)
6. Find and support local champions
7. Build communities of practice within organisations while introducing app building skills

What leads to success rather than failure is highly dependent on the specific context of a project. As such, future research projects are advised to look at case studies in this report with similar scope, timelines and goals as their own project to find contextually-sensitive guides to MAD adoption.

3 Background

3.1 Introduction

ACIAR is committed to meeting the reporting requirements of the broader Australian aid program. Traditionally this has been achieved through reports on outputs, outcomes and impacts of the research ACIAR supports. However, with the advent and ubiquity of mobile digital technology, information of activities in the field can be monitored in near-real-time, providing projects with greater capability to report more efficiently and effectively. Adopting mobile data collection can also assist the employment of evidence-based adaptive management strategies to ensure successful delivery of the research. As such, the utility of mobile acquired data (MAD) applications for more efficient data collection is being investigated with an aim to inform decision making, "*identify opportunities, ensure accountability, and maximise the impact of limited resources*"[1]. In fact, a number of Australian Government initiatives are harnessing the benefits of digital data to more effectively deliver services. Examples include the Digital Continuity 2020 policy[2] and the "Data for Health Partnership"[3]

In this context, adopting the use of new MAD applications (using iPhones, android, etc.) to address the shortcomings of the 'tried and true' paper based survey seemed quite appealing. However, understanding and assessing the multitude of specific technologies available remained a challenge. Furthermore, how these MAD applications (or MAD apps) best address the needs of ACIAR management, research project teams and even smallholder farmers was unclear. A series of Small Research Activities (SRAs) conducted between 2015 and 2016 were commissioned by ACIAR to help build that understanding (Figure 1).

[1] M. R. Bloomberg, J. Bishop 2015, "Understanding death, extending life". The Lancet 2015, Vol 386, e18-e19.

[2] Digital Continuity 2020 Policy, National Archives of Australia.

[3] "Better Data for Health Partnership" is a program with the Innovation XChange, Department of Foreign Affairs and Trade, to establish a large scale data collection system to use data to better manage public health issues.

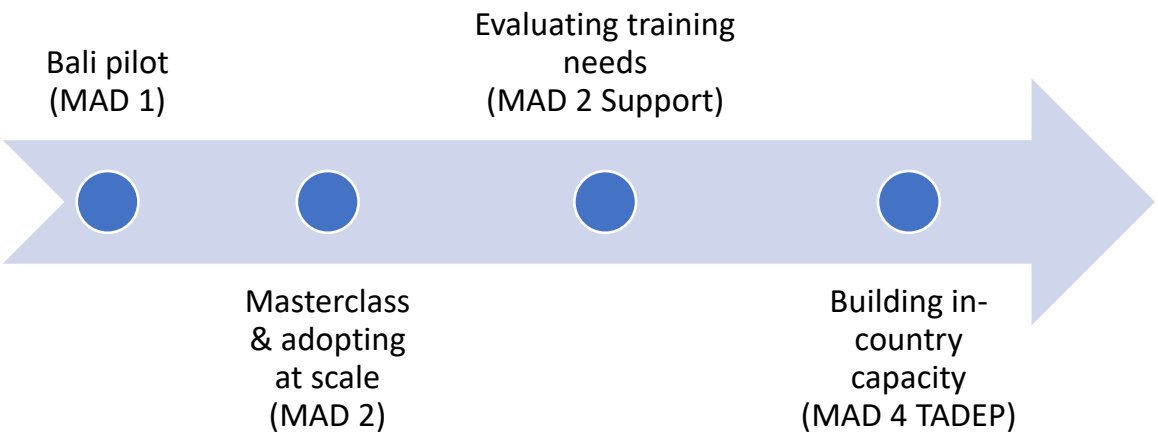

Figure 1: Outline of the four Mobile Acquired Data (MAD) SRA projects commissioned by ACIAR between 2015 and 2016

3.1.1 The Bali pilot (MAD 1)

In 2015 a detailed investigation was undertaken to examine limitations and strengths of various commercially available digital data collection applications. In particular, the applications were assessed for their use by ACIAR research projects in monitoring and evaluation (*GMC/2015/016 – "Assessment of digital data collection applications to support ACIAR's M&E*"). Known as the 'MAD pilot', this SRA included a series of field tests in a microcosm of a typical ACIAR project. The pilot sought to provide a proof of concept for digital data collection in the ACIAR project context, and push the limits of the apps being tested. The MAD pilot identified a number of critical features necessary to ensure successful implementation of such technologies by ACIAR research projects. For instance, one of the apps tested in the field had the ability to link surveys (perform case management) offline, linking the surveys on the device. This feature of the application was deemed to be critical for the successful implementation for most ACIAR projects.

It was evident from the pilot that these technologies could indeed provide project teams with access to near-real-time data. This can assist evidence-based adaptive management by project teams and allow the timely delivery of feedback for project stakeholders (including farmers). The pilot also suggested that near-real-time data access enhanced the interaction between user groups (i.e. farmers, researchers, field staff, management and ACIAR). In addition to this, apps were able to revolutionise research projects' ability to capture rich case studies. The device's ability to capture information, beyond alpha-numeric text (i.e. photos, audio, video or GPS) can be structured to capture impromptu case studies more systematically. This could significantly improve ACIAR research projects' ability to capture unintended consequences of their research. Critically, project leaders would also be able to use these case studies (along with the appropriate metadata) for communications and advocacy purposes. This will almost certainly have downstream benefits to ACIAR's communications portfolio.

Outside the scope of the pilot was identifying the level of capacity building and planning that is required to successfully implement data collection apps into ACIAR projects. Furthermore, although the pilot evaluated the experiences of the different user groups in the data value chain (i.e. farmers, field researchers, senior researchers, project leaders and ACIAR), it was concluded the apps should be evaluated at scale and across a broader group of projects to truly assess the value add of apps to ACIAR research projects.

3.1.2 Scaling up and training support (MAD 2)

In early 2016, a second MAD SRA (known as MAD 2, Phase I) was commissioned to identify the most appropriate approach for evaluating the adoption of apps in ACIAR projects (*GMCP/2015/021 - Scoping Study and Masterclass to scale up the findings from the Mobile Acquired Data Pilot*). The outcomes from this second SRA were:

- A commitment from four ACIAR funded projects (core projects) to adopt the apps and work with the SRA team to evaluate app performance in their respective projects.
- Development of a detailed evaluation framework for the assessment of the apps at scale.
- Design of questionnaires and app tools for the core ACIAR projects to assess the apps.
- A three-day Masterclass (June 2016) involving ACIAR staff, the four core projects plus other invited projects, Dimagi (the commercial app provider) and invited guests (e.g. DFAT and other government departments/agencies) to extend the findings from the MAD pilot and build the capacity of ACIAR research projects with respect to use of apps in project activities.
- The establishment of a public private partnership between ACIAR and Dimagi. The agreement was based on Dimagi funding 50% of their attendance at the MAD Masterclass and providing pro bono Advanced CommCare packages to the four core ACIAR projects for a period one year (valued at US$48,000).

At the conclusion of the masterclass, ACIAR management noted that the four core projects faced a number of challenges in their adoption of mobile data collection apps. As a result, two new SRAs were commissioned.

The first new SRA was a second phase of MAD 2 to work with the four projects in evaluating MAD apps at scale (*GMCP/2016/004 - At-Scale Evaluation of Digital Data Collection Apps in ACIAR Projects - Mobile Acquired Data Phase 2, otherwise known as MAD 2, Phase II)*. This project aimed to assess the

The second new SRA (known as MAD 3) was commissioned to evaluate the training needs and associated costs for research projects adopting MAD apps (*GMCP/2016/042 - Evaluation of staged adoption and implementation strategy, otherwise known as MAD 3*).

The four core projects participating in these MAD 2 Phase II and MAD 3 were:

- AGB/2012/059 – Towards more profitable and sustainable vegetable production systems in north-western Vietnam (AKA Vietnam Vegetables)

- LPS/2016/011 - Improving smallholder dairy and beef profitability by enhancing farm production and value chain management (AKA Pakistan Dairy)
- LPS/2014/037 - Increasing the productivity and market options of smallholder beef cattle farmers in Vanuatu (AKA Vanuatu Beef)
- SMCN/2011/046 - Diversification and intensification of rice-based systems in lower Myanmar (AKA MyRice)

3.1.3 A common platform for programs (MAD 4 TADEP)

MAD 4 TADEP was designed to evaluate the benefits of multiple, diverse projects within a common program all adopting the same digital data technology (CommCare). The 'Transformative Agriculture and Enterprise Development Program' (TADEP) in Papua New Guinea (PNG) was selected as a suitable case study for this evaluation.

In addition, during the 2016 Masterclass (MAD 2, Phase I), ACIAR TADEP project managers highlighted the need to develop in-country standalone MAD capacity. This was seen as critical to the long-term sustainability of MAD adoption in research for development. As a result, ACIAR requested MAD 4 TADEP also evaluate various approaches to supporting country partner capacity building.

PNG is a country of high priority for digital data collection applications (apps). This is due to the significant infrastructural and labour challenges faced by project partners. The primary in-country partner institution is the National Agricultural Research Institute (NARI). Building capacity for digital data collection within NARI was considered to bring benefits to both existing as well as future NARI projects, while also creating a skilled resource pool of app builders and enumerators for future ACIAR-funded projects. Using the expertise of AgImpact and the staff and facility of the National Agricultural Research Institute (NARI), the MAD 4 TADEP SRA was commissioned (*GMCP/2016/044 - Mobile Acquired Data for the Transformative Agriculture and Enterprise Development Program*).

3.2 This report

This document is the final report for the SRA projects GMCP/2016/004 (MAD 2) and GMCP/2016/044 (MAD 4 TADEP). An outline of the objectives (Section 4) and methodology (Section 5) in each SRA is provided. The proposed activities and outputs are outlined along with their respective achievement and delivery (Section 6). This is followed by the presentation of case studies from the MAD 2 SRA (Section 7.1) detailing the adoption of Mobile Acquired Data by each participating ACIAR project. Results from the MAD 4 TADEP SRA are also given in the form of case studies (Section 7.2) detailing the capacity building to individual ACIAR projects included in the TADEP program. The report follows with a wider discussion (Section 7.3) addressing the research questions around the benefits and challenges of adopting mobile acquired data applications, user experiences, the most effective approaches to scaling, the value in a common platform, and the lessons learned from capacity building. The report concludes with a series of recommendations for future projects, institutions and to ACIAR itself when considering the use of Mobile Acquired Data (Section 8). Additional materials are provided in the appendix (Section 10).

4 Objectives

4.1 MAD 2

The objective of *GMCP/2016/004 - MAD 2* was to evaluate the adoption and roll out of MAD apps across four core ACIAR research projects. In addition to this, a second objective was to develop and test various app adoption advocacy and scale out models to promote the use of apps more broadly amongst the ACIAR research community.

Research questions for the MAD 2 SRA included:

1. What is the extent of training and support required by research project teams to effectively adopt and mainstream apps into their research projects? In simple terms, the SRA will evaluate the four core projects capacity to use the apps.
2. What are the benefits and trade-offs for projects receiving the various levels of capacity building and program management support for app adoption and use? In simple terms: The SRA will evaluate the support on offer to the projects.
3. What is the value-add of apps to ACIAR research projects? In simple terms: Evaluate the value add of the apps
4. What are the effective methods for scaling out the adoption of apps across ACIAR funded projects?

4.2 MAD 4 TADEP

The objective of *GMCP/2016/044* - MAD 4 TADEP was to support the TADEP projects in the adoption of CommCare into their project activities as a means of addressing some of the challenges of working in PNG (i.e. current methods of project data collection are slow and can be inconsistent, creating lengthy project delays).

Research questions for this SRA included:

1. What are the specific advantages and disadvantages to an ACIAR program (such as TADEP) when all projects implement the same app technology and receive coordinated adoption support?
2. What are the specific advantages and disadvantages to an ACIAR project when all projects within a program implement the same app technology and receive coordinated adoption support?
3. Is it possible to develop an in-country partner's institutional capacity regarding adoption of apps? What lessons can be learnt for other programs which might be looking to develop such an approach?

5 Methodology

5.1 MAD 2

The SRA team engaged with the four core ACIAR research projects to develop implementation plans and help design an evaluation methodology for MAD applications. The methodology used in the SRA are provided here for each specific research question included in the original SRA proposal.

- **Assess the technical and project planning capacity building requirements of each project to effectively incorporate the use of apps in their projects.**

Each project performed an independent capability and needs assessment in the areas of technical requirements, capacity building and program management planning in the use of CommCare. This was conducted using Dimagi's Maturity Model.

What is the Maturity model?

The Maturity Model is an assessment template that determines the suitability of MAD technologies for a project and their associated support needs. It was designed by CommCare developer Dimagi and in the form of a 30 minutes Excel-based questionnaire. The model is based on the Dimagi's experience assisting over 300 distinct clients implement CommCare in their work. Clients complete the questionnaire as a form of needs-assessment which also provides a roadmap for implementation. This roadmap prioritises capacity building in projects based on project-nominated goals. The outcomes are then used to select appropriate support packages for the client.

How did we test it?

The MAD 2 SRA employed the Dimagi maturity model when first engaging with the case study projects. Staff from each project were asked to complete the maturity model questionnaire, and the results (Appendix 2) were examined to see how support may be provided. Once the projects had conducted their assessment, the process was repeated with a skilled CommCare technical expert from AgImpact. This second round of questionnaire also resulted in an AgImpact tailored needs assessment which was used to contrast the Dimagi model. There were two purposes for this approach: to ensure accuracy of the assessment, as it would form the basis for implementation support for the following 12 months; and to test the suitability of the Dimagi Maturity Model, designed for large scale projects, to typical ACIAR projects.

Issues with this approach

One point to note about the Maturity Model is that it is, in the first instance, a needs assessment for implementing digital data collection via CommCare. However, in the context of MAD 2, the projects had already decided that they already 'needed' CommCare. The projects had made the choice to implement MAD in their activities and therefore the needs assessment component of the Maturity Model was redundant. While this was true for the MAD 2 SRA context, it does not mean that future ACIAR projects would not benefit from a needs assessment process to determine if their project can benefit from implementing MAD in their research activities.

- **Facilitate and support the effective implementation of apps into four selected ACIAR projects.**

Using the information from the needs assessment (from both the Maturity Model and individual CommCare expert), the SRA team and projects developed an agreed allocation of support for each project. The type of technical support and capacity building provided was closely linked to the project's technical skills, the intended use of CommCare by the project, and the specific features required by the project (based on their research activities). The technical support structure designed by AgImpact for this SRA, and used across both MAD 2 and MAD 4 TADEP one on one support activities, was structured as follow:

i. **Needs assessment**: Working with projects to assess the level of value they believe CommCare and the SRA team can add to their project and determine whether to proceed. Determine activities for which the project requires AgImpact support, and what level of support will be provided.

ii. **Planning**: Working with projects to assess their current capability for planning the effective adoption of CommCare at the project establishment stage (identifying barriers, opportunities and next steps). Brainstorm ideal data analysis and outputs that meet project KPIs. Prepare stakeholders to reverse engineer their application requirements.

iii. **Train and Build**: Capacity-building to create self-sufficiency in survey form building, testing, data collection/management, and field team performance. In-person tailored training sessions to develop app design and building skills among nominated project staff. Advising on how best to structure applications, modules and forms in CommCare to maximise efficient data management for the intended project use.

iv. **Test and Deploy**: Assistance in planning project-run field testing to ensure applications bugs and design issues could be properly identified. Working with projects on how best to refine application structure, modules and forms in CommCare based on field testing (or piloting). Assistance in editing/updating more advanced application features where in-project technical capacity was not sufficient.

v. **Monitor and Evaluate**: Provide extensive technical support, working closely with projects to ensure they are field-ready to deploy and manage data collected from the field in near real time.

The result was a range of support days allocated across the four core projects. This varied from 15 (project team with high technical capacity) to 30 (project team with limited technical capacity). Details of the tailored support packages provided to projects are outlined in the case studies in Sections 5 and 6 of this report.

- **Evaluate the various user experiences and adoption rates of apps across the four participating ACIAR projects as well as capturing any unintended consequences around MAD adoption of other ACIAR projects.**

During the SRA, the SRA team captured material on user experience and adoption of CommCare through interviews with project staff and in-country visits during periods of

training or app use. Data were also collected through baseline and endline enumerator surveys across the four projects. These were used to measure changes in digital literacy (i.e. capacity building) and user experiences with CommCare.

User experiences

User experiences with CommCare were captured in the form of simple Likert Scale questions with respondents selecting one of several discrete levels of attitude towards MAD adoption and support. These focused on rating the difficulty of various phases of MAD implementation (e.g. training, application building, etc) as well as rating how useful different support mechanisms were during the SRA. Enumerator experiences were also measured by asking respondents to rate their agreement with statements around the effect MAD applications had on survey experience and relationships. The results of these activities are presented within the project case studies in Sections 7.1 and 7.2 of this report. The user experience and adoption rates are also discussed in a dedicated discussion Section 7.3.

Digital literacy

As an intangible and emerging competency, measuring digital literacy is not a straightforward task. Researchers have defined 'digital competence' as a combination of operational, formal (i.e. 'the skills to handle the special structures of digital media such as menus and hyperlinks'), problem solving and information skills (Ferrari 2012, van Deursen & van Dijk, 2010, 2011, 2015). Further refinements of this concept have added strategic dimensions such as the skills to 'employ the information contained in digital media as a means to reach a particular personal or professional goal' (Van Deursen et al. 2016). The importance of non-technical skills such as the critical and social ability to 'search, collect and process information and use it in a critical and systematic way' (Peña-López, 2010) have been flagged. The Australian Digital Inclusion Index (2016) adds access as a crucial sub-factor; and the ASEAN Women's ICT Development Index prepared for developing contexts that have only recently engaged with the digital age introduces ICT readiness (ICT use and prior ownership of devices) as a key measure.

The digital index used in this SRA combines three questions which help to understand each respondent's experience and confidence with digital technology.

1. How confident are you with using an Android device?
2. Do you have any experience using mobile apps for surveys data collection?
3. How confident are you using mobile apps for surveys?

These questions were administered in the baseline survey before the 106 enumerators had gained any field experience with the apps, as well as during endline survey after fieldwork was completed. Results on digital literacy capacity building are discussed in section 7.3.2.

- **Develop and deliver a Mobile Acquired Data (MAD) Masterclass to scale out and promote the findings of the SRA.**

The goal of the Masterclass at the project outset was to create a forum for cross project information sharing on app experiences and effective reporting. In August 2017 a (renamed) 'MAD Showcase' was held in Canberra. The Showcase was much larger than originally anticipated, with over 80 delegates registered to attend. It featured a series of interactive sessions and panels that presented the SRA findings and key app implementation issues. The showcase also enabled core project leaders who could attend to share their experiences and recommendations to other projects, organisations and Agencies. A summary of the MAD Showcase is included in Appendix 4 of this report.

Information around the adoption by other ACIAR projects has also been captured through discussions with ACIAR directly, and through support requests to AgImpact from ACIAR projects outside the core four and TADEP projects.

Other scaling out activities during the MAD 2 SRA included

- The delivery of a two-day training workshop for early-career researchers in collaboration with the RAID network (Researchers in Agriculture for International Development).

The benefits and trade-offs of these scaling out methods were compared with the 'projects as champions' approach and 'programs as champions' (i.e. MAD 4 TADEP SRA). This evaluation of scaling methods is presented in the discussion Section 7.3.4 of this report.

- **Communicate the findings from the SRA through a series of video packages and in country multimedia capacity building exercises.**

The journey of app training and adoption, deployment and results were captured and edited into four video packages (See Appendix 1, Section 10.1). The target audiences are ACIAR project leaders, researchers, field researchers, in country partners and the broader ACIAR research community.

5.2 MAD 4 TADEP

The broad methodology adopted for this SRA was the provision of tailored, technical support via in-country workshops and one-on-one training to support the adoption of a common app (CommCare) by the five ACIAR projects that sit within the TADEP program. These five participating ACIAR projects were:

- Improving opportunities for economic development for women smallholders in rural Papua New Guinea (ASEM/2014/095 AKA "Family teams")
- Enhancing private sector-led development of the Canarium industry in PNG (FST/2014/099 AKA "Canarium")
- Developing the Cocoa value chain in Bougainville (HORT/2014/094 AKA "Bougainville Cocoa")
- Enterprise-driven transformation of family Cocoa production in East Sepik, Madang, New Ireland and Chimbu Provinces of Papua New Guinea (HORT/2014/096 AKA "PNG Cocoa")
- Supporting commercial Sweetpotato production and marketing in the PNG highlands (HORT/2014/097 AKA "Sweetpotato")

Similar to the core research projects involved in the MAD 2 SRA, each TADEP project was interviewed by the SRA team and asked a series of questions relating to their project activities and app capability and capacity (note that the Maturity Model was not used with these projects). These interviews were used to assess the CommCare support requirements of each project, to be provided over a 12-month period. Based on this needs assessment, an agreed provision of technical support was allocated to each individual project. Dimagi provided pro-bono CommCare packages to participating TADEP projects (specific to project needs). The structured support was provided in the form of project-

specific one on one support over email, phone and skype as well as training meetings both within Australia and in-country.

Building on the MAD 2 SRA, MAD 4 TADEP also delivered institutional training to the National Agriculture Research Institute (NARI), Papua New Guinea. NARI is a partner organisation to three of the five TADEP projects and it was agreed that a coordinated effort to foster CommCare capacity building within NARI ought to be undertaken.

The SRA team developed a specialised institutional training program and related material for NARI, delivering the course to a small group of selected staff via two in-country sessions. The training course introduced NARI staff (in addition to those already captured in the TADEP project activities) to CommCare and generated institutional enthusiasm for MAD apps.

Two members of the SRA team also attended the TADEP annual meeting, held in Cairns in June 2017 to collect data on the app adoption experience of the projects.

The collection of video footage and production of a short film was also included in this SRA, to complement the work commissioned under the MAD 2 SRA. This short film focused on the journey of app training and adoption. The key output of this was the 'Jeromy/NARI film', and the 'MAD 4 TADEP lessons learned film' delivered to ACIAR in June and July 2017.

6 Achievement against activities and outputs/milestones

6.1 Achievements

Tables 1 and 2 below list the proposed achievements in the MAD 2 and MAD 4 TADEP SRAs respectively. For each activity, details are provided along with the delivery outcomes and relevant report sections (where appropriate).

Table 1: Proposed activities and their achievement status for the MAD 2 SRA

Activity	Activity details	Achievement status and relevant material
Assess the technical and project planning capacity building requirements of four selected ACIAR projects to effectively incorporate the use of apps in their projects	Assist four core ACIAR projects in performing an independent capability and needs assessment in the areas of technical requirements, capacity building and program management planning in the use of apps.	Assessments conducted using Dimagi's Maturity Model (Appendix 2) and a tailored assessment by AgImpact (Section 7.1).
Facilitate and support the effective implementation of apps into four selected ACIAR projects.	Support will be provided by the SRA team and Dimagi to the core projects in the areas of technical and program management capacity building. The type of technical capacity building will be closely linked to the CommCare features required by the projects and the	All support provided. Details given in the 'MAD Activities' subsection of the relevant case studies (Section 7.1)

	technical skills that exist in the project teams.	
	Support will be provided to project leaders looking to explore the use of data management tools, dashboards, and different stats programs to develop the 'post data collection' options for researchers. Both for 'reporting' to RPMs but also in the sense of having results in real time.	Support in data management provided to Vanuatu Beef and Vietnam Vegetables projects (Section 7.1)
Evaluate the various user experiences and adoption rates of apps across the four participating ACIAR projects	To be presented as a series of project case studies. The evaluation methodology will be based on the user evaluation designed developed in the recent MAD SRA. The 'stories' app survey feature developed in MAD I will be utilised by the SRA team to capture 'app stories' from the various project user groups to identify any of the unintended consequences	User experiences captured through ongoing completion of feedback forms by projects. All individual project details provided in the case studies (Section 7.1) and discussion (Section 7.3.3).
Develop and deliver a Mobile Acquired Data (MAD) Showcase to scale out and promote the findings of the SRA	The goal of Showcase is to create a forum for cross project information sharing on app experiences and effective reporting. The Showcase will involve the selected core ACIAR projects and the SRA team, plus a second tier of ACIAR projects not initially involved in the SRA. The Showcase design will focus on sharing case study experiences and the findings from the SRA.	Delivered after the Annual Crawford Conference in August 2017. A Showcase report (including evaluation) is provided in Appendix 4.
Communicate the findings from the SRA through a series of video packages and in country multimedia capacity building exercises	The journey of app training and adoption, usage and results will be captured and edited into three video packages. The target audiences are ACIAR project leaders, researchers, field researchers, in country partners and the broader ACIAR research community	Activity completed. Delivered the 'MAD Summary' film (length: 9:19) in September 2017. https://www.youtube.com/watch?v=kHZJ5u6WuC4
Capture stories of app adoption outside core projects along as well as the unintended consequences from sharing the learnings from the MAD 2 SRA	Through communication with ACIAR, the team will keep track of whether projects outside the core projects decide to implement CommCare as a result of hearing about the learnings/advocacy from the MAD SRAs, and capture anecdotally their experiences	Activity completed. Details of MAD adoption by other ACIAR and non-ACIAR projects provided in scaling methods evaluation (Section 7.3.4). Unintended consequences within SRA projects also captured in the 'MAD Summary' film.

Table 2: Proposed activities and their achievement status for the MAD 4 TADEP SRA

Activity	Activity details	Relevant achievement material
CommCare one on one technical support and capacity building	Each TADEP project was interviewed to assess their CommCare support requirements. Support days were allocated to projects in the proposal and this was to be provided over a period of 12 months.	Support to each project was provided throughout the SRA period. The actual days of support given were determined by project requests during the SRA period, with some not utilising all available days. Details of this are provided in the relevant case studies (Section 7.2).
CommCare Masterclass	Involving TADEP project researchers and selected NARI staff. The masterclass will be delivered as one element of the training and capacity building activities undertaken in this SRA, supported by extensive one-on-one project training	The original planned Masterclass was to coincide with the TADEP annual meeting. Due to a last-minute rescheduling and prior commitments of the SRA team, this Masterclass could not be held. Instead, the TADEP annual meeting was attended by two SRA team members to collect input on support needed during project. Consultation with ACIAR led to Masterclass time being allocated to individual projects instead.
NARI capacity building	No details provided	NARI capacity building was delivered over two workshops (November 2016 and February 2017). Details provided in section 7.3.4.
Evaluation	No details provided	Evaluation of support provision, scaling methods, value add of apps to ACIAR and technical, institutional and financial support needed for MAD adoption provided in Section 7.3.
Video capture and capacity building	The focus of the video will be capturing the story around the program as a whole, touching lightly on the other TADEP projects and delving into one project only in depth. The filmmaker will travel to at least one of the core project sites during the relevant periods of app usage in the field. Footage capture will be collected from the Masterclass and the April TADEP Annual Meeting	All activities (except for filming TADEP Annual Meeting) completed. Relevant final film links below: 'TADEP lessons learned' film https://www.youtube.com/watch?v=kHZJ5u6WuC4 'Jeromy Kavi' film https://www.youtube.com/watch?v=TP9Fu2eNhkQ 'MAD Summary' film https://www.youtube.com/watch?v=kHZJ5u6WuC4 'Top tips for photo and video' https://www.youtube.com/watch?v=rDzuk7p7HVI

6.2 Outputs

Tables 3 and 4 below list the proposed outputs in the MAD 2 and MAD 4 TADEP SRAs respectively. For each output, details are provided along with the delivery outcomes and relevant sections (where appropriate). Most outputs in both SRAs were in the form of reporting provided in this document. Where this was not the case, the relevant materials are given. The two SRAs have delivered on all key outputs proposed except for the evaluation of requested photo-story capture workshops (given in a separate project) and the proposed Masterclass in PNG (MAD 4 TADEP). Instead of the Masterclass, the MAD 4 TADEP SRA shifted its focus to building capacity within the partner organisation NARI. The SRA also delivered additional outputs in the form of short films to compensate for the lack of Masterclass in the MAD 4 TADEP project.

Table 3: Proposed outputs and their delivery for the MAD 2 SRA

Outputs	Output details	Relevant output material
Final report (this report)	An assessment of the suitability of the CommCare Maturity Model in determining ACIAR project capacity building requirements for app adoption	Maturity model (Appendix 2) and needs assessment results (Section 7.1)
	Case studies for each of the core ACIAR projects capturing the benefits and challenges of the app support available	Section 7.1
	An assessment of the value adds of apps to ACIAR projects	Section 7.3
	An evaluation of the various methods of scaling out the adoption and effective use of apps	Section 7.3
	An evaluation of any requested photo/story capture workshops to inform ACIAR of future training requirements	This activity was adapted over time in consultation with ACIAR and led to AgImpact supporting Conor Ashleigh to prepare a communications training workshop for ACIAR Country Managers in Lombok, Indonesia. A URL link to a short video capturing some of what was delivered in this workshop is provided in Section 10
	Masterclass material, including: reference materials, program, presentations and participant evaluation	Previous MAD scoping study report, MAD Showcase report (Appendix 4) Masterclass films: 'Top tips for photo and video' https://www.youtube.com/watch?v=rDzuk7p7HVI 'Top tips for Security and consent' https://www.youtube.com/watch?v=q3YqnPGE7qI 'Top Tips for Data' https://www.youtube.com/watch?v=sFiyJ6AOGK8
Showcase	Delivered to core projects and other identified and agreed ACIAR projects	MAD Showcase delivered August 9, 2017). Report of Showcase included in Appendix 4 (Section 10.5).
Videos	ACIAR-focused MAD video (7 minutes)	'MAD Summary' film (length: 9:19) https://www.youtube.com/watch?v=kHZJ5u6WuC4

	ACIAR comms focused video (2-3 minutes)	'Jeromy Kavi' film (length: 4:10) https://www.youtube.com/watch?v=TP9Fu2eNhkQ 'Vanuatu Beef' film (length: 5:43) https://www.youtube.com/watch?v=Q_JD_a38mcc
	ACIAR project scale-out video (2 minutes)	'TADEP lessons learned' film (length: 5:43) https://www.youtube.com/watch?v=E-BpaQdaREg&t=21s

Table 4: Proposed outputs and their delivery for the MAD 4 TADEP SRA

Outputs	Output details	Relevant output material
Final report (this report)	Evaluation of MAD roll out across five case studies	Section 7.2
	Technical, institutional and financial support required	Section 7.3
Masterclass	Involving TADEP project researchers and selected NARI staff. The masterclass will be delivered as one element of the training and capacity building activities undertaken in this SRA, supported by extensive one-on-one project training	The original planned Masterclass was to coincide with the TADEP annual meeting, due to a last-minute rescheduling and prior commitments of the SRA team, this Masterclass could not be held. The annual meeting was subsequently attended by two SRA team members to collect input on additional support needed by project. Consultation with ACIAR led to Masterclass time being allocated to individual projects instead. NARI institutional training was conducted in MAD 4 TADEP SRA in December, 2016 and March 2017. One-on-one project training: Delivered (see section 7.2 for details)
Videos	A multimedia/video package will be produced, capturing the journey of projects utilising CommCare in TADEP and the change in perceptions over the course of this SRA. One project will be followed in detail, with the rest touched on in order to 'tell the story'. The professional videographer engaged by the project will also provide capacity building to in country project and project partner staff in the capture and use of photos and videos. All footage will be of a high resolution and all raw material will be supplied including metadata referencing the location, description and names of people pictured	'TADEP lessons learned' film https://www.youtube.com/watch?v=kHZJ5u6WuC4 'Jeromy Kavi' film https://www.youtube.com/watch?v=TP9Fu2eNhkQ 'MAD Summary' film https://www.youtube.com/watch?v=kHZJ5u6WuC4 'Top tips for photo and video' https://www.youtube.com/watch?v=rDzuk7p7HVI

7 Key results and discussion

7.1 MAD 2: Benefits and challenges in MAD adoption at scale

This section provides a series of case studies on the four MAD 2 projects to detail the benefits and trade-offs for each project of capacity building and program management support for app adoption and use. The case studies outline key points, basic project information, the MAD activities that took place, how MAD apps were integrated (i.e. planning, testing, deployment, fieldwork and data management) before discussing specific benefits and challenges. Data from the enumerator surveys and user feedback forms (i.e. project staff experiences) are also included. Key lessons from each project are provided at the conclusion of the case study.

7.1.1 Vietnam Vegetables

Key Points

Project Title: Towards more profitable and sustainable vegetable systems in north western Vietnam

Project code: AGB/2012/059

Location: Lao Cai province, Hanoi, Ho Chi Minh and Son La cities, Vietnam

Systems studied: Smallholder vegetable production

Research Activities: 2 x 2,500 household surveys (rural and urban, baseline and endline);

Lead Institution: The University of Adelaide

Partner institutions:

> Australia: University of Queensland, NSW DPI, Department of Foreign Affairs and Trade
> Vietnam: Vietnam Women's Union, Institute of Policy and Strategy for Agriculture and Rural Development, Vietnam National University of Agriculture, Fruit and Vegetable Resource Institute, Soil and Fertiliser Research Institute, National Institute of Medicinal Materials, Plant Protection sub-department of Lao Cai

Disciplinary focus: Biophysical (vegetable resource and disease management practices) and socioeconomic (value chain analysis and market settings)

Project stage for MAD implementation: 3rd year of 4 year project, start of associated PhD study

Level of research staff experience with MAD: High technical capacity among researchers but untrained in MAD at the commencement of adoption

MAD activities: Rural household survey with short adoption time and urban household survey with a medium (2-3 months) adoption time

MAD feedback mechanism: In-app issue reporting form, real-time feedback via electronic messaging, daily reports to research managers, Prof Wendy Umberger and enumerator team as data was being collected

Key lessons:

- Adopting MAD apps for this project reportedly saved an equivalent 1,250 enumerator days of work
- Third party app builders should complete the application in a project space accessible to the project team. Additionally, there should be a requirements gathering and planning phase to ensure the project's needs will be met by the end product.
- When outsourcing enumeration have an exchange of policies before the application is built.
- High general technical capacity among researchers dramatically reduces the MAD training burden.
- Ad-hoc feedback and updates to the application (as opposed to scheduled, batched updates) increase the time required for testing, issue resolution and updates to translations.
- The use of devices for digital data collection should be leveraged to provide a platform for real time communication between enumerators, field supervisors and researchers.

Project Background

This project aimed to assess the profitability and sustainability of smallholder vegetable farmers in North Western Vietnam. The project worked to improve engagement between vegetable producers and urban markets to allow smallholder access to higher-value markets. Surveys were used to collect data on urban market consumption patterns which would be used to help market local vegetables. The project was managed by the Centre for Global Food and Resources at the University of Adelaide led by Dr Dale Yi, with MAD implementation led by Prof. Wendy Umberger, Mr Christian Genova and Mrs Jesmin Rupa.

More information about the overall project can be found on the ACIAR website (http://aciar.gov.au/project/agb/2012/059).

Perceptions and previous experience of MAD technologies

The Vietnam Vegetables researchers had no previous exposure to CommCare but they had a high level of competence in other research-related software. The relevant Research Project Manager (RPM) was generally positive about the prospect of implementing MAD technologies (Table 5). As project leader, Professor Umberger's greatest concern was that the technology would involve a steep learning curve which could translate to high costs for the project. There were also concerns in translating the applications to local languages and the ability of them to perform in very remote locations (Table 5). There was an expectation that there would be increased efficiency in analysis time from MAD. There was also some excitement about the potential for capacity building of researchers and enumerators. App managers themselves were the most concerned at the beginning of the project. In particular, they foresaw issues around data security & ownership and internet coverage (Table 5).

Table 5: Perceptions of various project staff on issues relating to adoption of MAD in their project. Data collected through baseline perception surveys at the beginning of the SRA.

Issue	**Research Project Manager**	**Project Leader**	**Project Leader**	**App Manager**
How do you rate your concerns around using apps in relation to the following issues?	*(On a scale of 1-5: 1= not concerned: 5= very concerned)*			
Data Security	3	2	3	5
Excessive data collection	2	4	1	1
Data ethics & use	2	3	3	3
Costs to projects	2	5	4	4
Data ownership (in country partners)	2	2	2	5
Hardware reliability	3	3	1	4
Language		5	2	3
Internet coverage/reliability		4	1	5
Cumulative totals (/40)	14	28	17	30

MAD Activities and support provided

MAD Activities

The project's rural component deployed a household survey with a production focus to 2500 households. The urban component deployed a household survey with a consumer focus to an additional 2500 households. Both were adapted from paper-based questionnaires into MAD applications. They were comprehensive, and the application designs were complex. Minimum interview time for each questionnaire was 3 hours.

The rural component required two follow-up household visits and the urban component a single follow up visit. The baseline applications for each respective component were duplicated and edited down for use in the follow up data collection.

Planning

The rural component outsourced application development to a third-party provider prior to the commencement of the MAD SRA. Needs assessment involved a brief, remote consultation and handover of the questionnaire in Excel format.

For the urban component, the developer met with the project lead and researchers for 1 day to review the challenges of the rural data collection and discuss the goals, logistics and timeline for the urban survey. A collaborative document defining delivery dates for content provision, development, testing and deployment was shared with all stakeholders.

Training & Building

PhD student Christian Genova received no MAD-specific training through the SRA, though he attended a separate 3-day MAD training session held at Melbourne University through the RAID network (Researchers in Agriculture for International Development). Christian also received one-on-one support from AgImpact staff early in the MAD 2 SRA. Jesmin Rupa had only a 2-hour introduction to data exports and worker monitoring reports.

The application built for the rural questionnaire was developed in a secure project space such that researchers had access only to the mobile interface and not the structure or data. No formal testing plan or feedback mechanism was adhered to by the developer or the researchers. For the urban component the initial development based on the Excel format questionnaire took only 5 days.

Testing & Deployment

A plan outlining how to test the application and collaborative documents structured to collect detailed feedback were supplied to researchers. While 2 rounds of feedback and 3 major iterations of the application were officially scheduled, in practice feedback was limited until the final weeks prior to deployment when 1500+ ad-hoc updates were made to the questions, workflow and translations.

Two different third-party enumerator companies were engaged for the respective rural and urban data collection. The urban enumerators were contracted much later in the process (weeks before deployment). Both companies employed experienced field supervisors to coordinate the enumerator teams and University of Adelaide researchers were in-country for the entire period in which interviews were conducted. A developer was on hand in Hanoi to support deployment for the first week of urban data collection. Researchers and field supervisors participated in the enumerator training held over 3 days. Uniquely, the urban component field researcher used a Zola internet messaging group to communicate with enumerators.

Monitoring and Evaluation

Researchers implemented a very thorough monitoring workflow to leverage the benefits of MAD. Collected data was reviewed every evening and potential issues were communicated to the field supervisor immediately for follow up the next day. Progress reports and key indicators were emailed daily to the project lead.

User experiences

Research staff

User experiences reported through the MAD 2 SRA feedback form suggest Vietnam Vegetables project staff did not struggle with MAD implementation. Feedback form responses indicated project staff found tasks in all phases of MAD implementation either 'Easy' or 'Normal' in difficulty (Figure 2). This may reflect the relatively high technical capacity of the project staff, something that distinguished it from most other case studies. With regards to the value of various support mechanisms provided during the SRA, project staff had mostly favourable views towards all support provided (Figure 3). One respondent found the CommCare user group was not useful, while AgImpact support was nominated as 'very useful' more than any other support provided. Only one respondent received support from other ACIAR projects, though they found this to be 'very useful'.

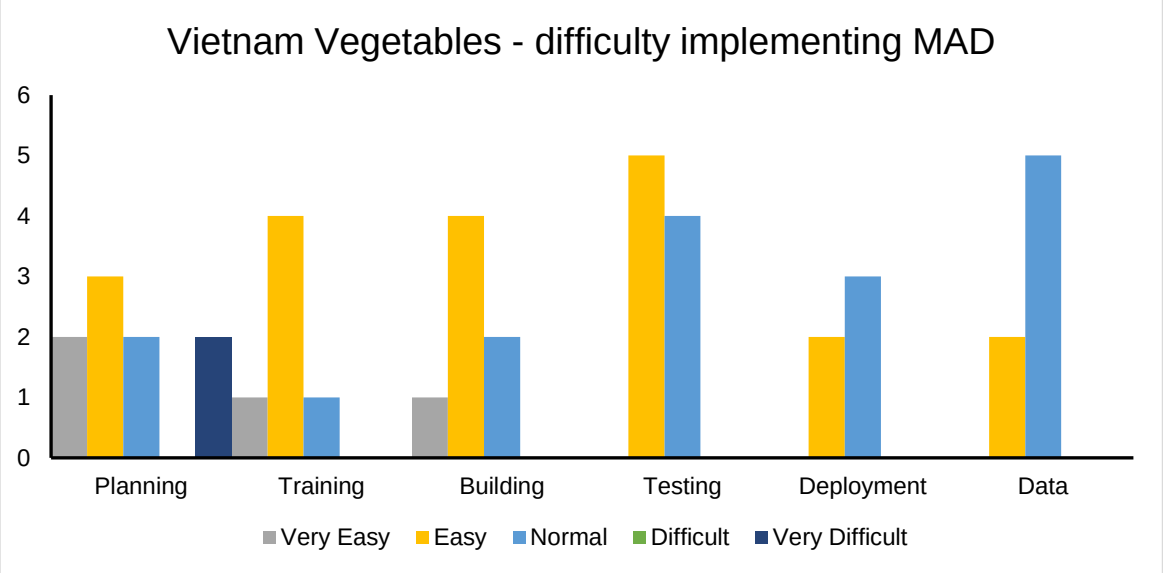

Figure 2: Ratings on the difficulty of various phases of MAD implementation from Vietnam Vegetable project staff. Total number of responses = 23. Responses recorded as 'Not Applicable' are not shown.

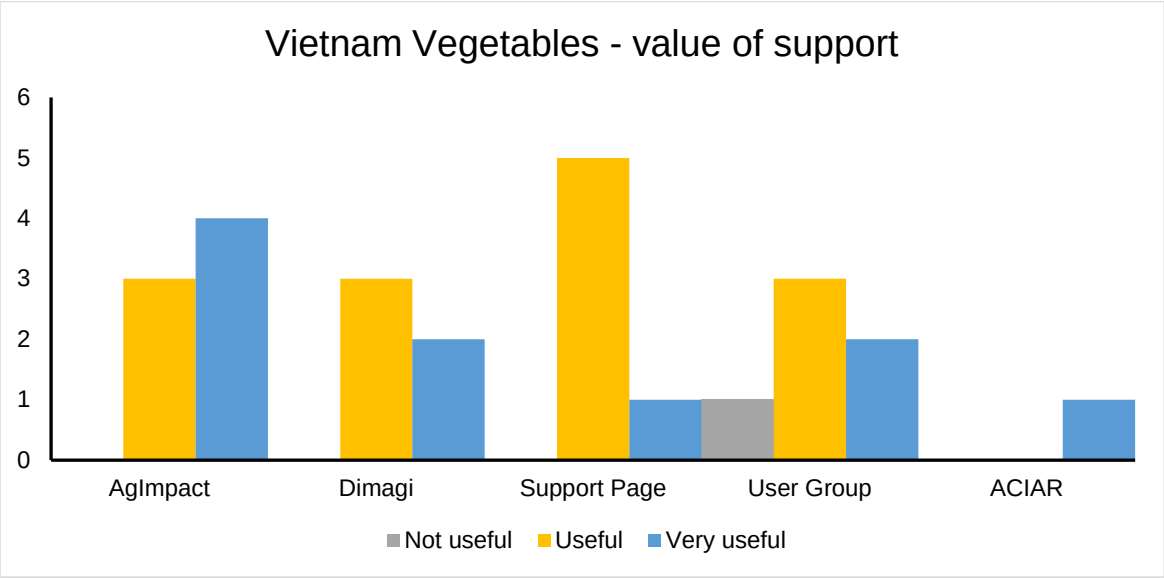

Figure 3: Feedback from Vietnam Vegetables project staff responses on the value of various support provided during the MAD 2 SRA. Responses recorded as 'Not Applicable' are not shown.

Enumerators

Results from baseline and endline enumerator surveys showed that the majority in both components felt that the apps improved fieldwork by making surveys easier and faster (Table 6). However, a lower proportion of enumerators in the rural component believed the apps made their work easier after completing the fieldwork – dropping from between 90% and 100% to between 62% to 92% (Table 6). On the other hand, the urban enumerators were initially more sceptical of the technology and more respondents reported favourable views of the technology after fieldwork was completed (Table 6). Almost no rural enumerators believed the apps changed the relationship between themselves and either their interviewees or their supervisors by the end of the fieldwork (Table 6). For urban enumerators, 34% believed it changed their relationship with the interviewees, and 40% said it changed their relationship with supervisors (Table 6).

Table 6: Vietnam Vegetables enumerators' perceptions of the role of MAD apps in data collection. Results shown include baseline and endline comparisons.

Survey question	Component	Baseline result	Endline result	Change
Survey responses (n)	Rural	20	13	- 7
	Urban	28	38	+10
Believe apps change interviewer-farmer relationship (%)	Rural	10	8	- 2
	Urban	11	34	+23
Believe apps change supervisor-interviewer relationship (%)	Rural	15	8	- 7
	Urban	14	40	+26
Believe apps make conducting surveys easier (%)	Rural	100	92	- 8
	Urban	46	63	+17

Believe apps make surveys faster to complete (%)	Rural	100	77	- 23
	Urban	46	74	+28
Believe apps collect data more accurately (%)	Rural	90	62	- 28
	Urban	14	45	+31

What were the benefits?

MAD implementation led to several benefits for the project. These included decreased time of data collection and entry, reduced data loss, enhanced enumerator experience, and greater ability to manage contractors.

Reduced interview times

The primary benefits identified by researchers were the reduction in interview time by 40%, from ~5 hours on paper to 3 hours using the MAD app, and the ability to easily identify enumerator errors remotely, in close to real time, so that the data could be corrected before moving on to a new location.

Faster data input

Another benefit was time for data import for analysis. Christian Genova reported that it took less than 1 day for the initial import of the data into STATA, a statistical analysis program. This represented a significant time reduction when compared with manual entry of data collected on paper. Both researchers who filled the role of app manager were very competent in MAD activities with minimal training because they had high general technical aptitude.

Reduced data loss

A third benefit was the reduced data loss when compared with paper-based data collection. Portions of the data collection completed on paper by householders (24-hour household consumption patterns) were much more prone to data loss and error than the portions collected via the MAD application with built-in validation.

Capacity building

A fourth benefit was in-country capacity building of enumerators. Only 30% of the rural enumerators responded that they were very confident in the use of mobile devices in the baseline survey. This number increased to 69% in the endline. The increase in confidence was even more pronounced when referring to their confidence using mobile apps for surveys.

Equipping enumerators with tablets and making use of internet messaging groups for communication had the unexpected benefit of promoting rapid issue resolution and real-time peer support. The messaging group was heavily trafficked and very popular. In-app forms for reporting bugs and translation issues were used for 80% of in-field issue reporting, ensuring developers received the information necessary to troubleshoot quickly. Enumerators also appreciated the embedded media in the application that helped them to prompt respondents about various food packaging, labelling and meat cuts.

Additional monitoring capabilities through MAD meant that the research team was more able to manage contractor work. Worker activity reports available in CommCare were useful in resolving a minor dispute with an enumerator company because the exact times to complete various forms were recorded and accessible in real time. The company also

required a sampling of the data be provided to them for the purposes of validation. A customised CommCare export was created to easily and securely facilitate this exchange.

Professor Umberger acknowledged that given the scale of the research and the time frame for reporting on the collected data, the use of MAD was the only logical approach, indicating she perceived overall net benefits.

What were the challenges?

Time allocation to application development

The Vietnam Vegetables project exchanged time savings in fieldwork and analysis for time investment in application development. A total of 65 combined days were spent by researchers on MAD activities, with more than 75% of that time dedicated to building and testing the two applications (Table 8). Additionally, of the 29 days support provided by AgImpact, 45% was tagged as building and testing.

Much of this AgImpact support time was spent in the weeks prior to deployment on resource intensive ad-hoc updates, with each update requiring testing to confirm app stability. Therefore, adhering to a fixed timeline for batched feedback and limited iterations could significantly reduce this resource burden. Team reviews by representatives from leadership, research and fieldwork are a good strategy for collecting and compiling feedback in a systematic way.

Issues with third-party development of Rural questionnaire

The application for the rural questionnaire was delivered by the third-party developer 5 days before enumerator training. Upon delivery, there were significant issues with the design that needed to be resolved by researchers and AgImpact developers. Portions of the proposed workflow could not be implemented in the limited time available. This meant that some of the required data was not collected. Most of the recorded time spent by the Vietnam Vegetables research team in ‘application building’ was used to fix issues with the rural survey app from the third-party developer.

Enumerator company policy conflict

After the enumerator company had reviewed and tested the urban questionnaire application, a number of changes were required. The length of the survey exceeded the estimate forming the basis of the contract between the enumerator company the University of Adelaide. As a result, portions of the survey needed to be cut or simplified. The enumerator company's ethics policy precluded the collection of the names of household members so numeric identifiers were substituted, altering the workflow of the application. The enumerators were accustomed to a specific method of generating household identification and did not accept the alternative of generating the IDs within the application. This caused some issues during data collection when household identifiers were incorrectly recorded and needed to be manually updated.

Unclear briefing on study design

Finally, insufficient communication regarding the requirements of the longitudinal aspects of the data collection meant additional time was spent adjusting the applications to suit the workflow of the follow-up visits.

Financial and time costs involved

Financial cost to project

The Vietnam Vegetables project team reported the MAD implementation operating costs as AUD $7,344. The devices used in the urban component were the same as for the rural, with only one device lost during the course of data collection. The cost of AgImpact

support was covered by ACIAR as part of the SRA and therefore was outside of the Vietnam Vegetables project budget.

Time costs

The total number of support days provided to the project by AgImpact was 29 (Table 7). Most of this time was spent during the building and testing phase and was provided as remote support. Six days were logged for travel and logistics. Project staff spent most time in building (31 days), testing (20 days) and data management and monitoring (18 days). In total project staff spent 94 days working on MAD adoption (Table 7).

Table 7: Time spent (days) by AgImpact staff (support) and Vietnam Vegetables project staff (implementation) in each phase of MAD implementation.

Support type	Activity	AgImpact staff (days)	Vietnam Vegetables staff (days)	Combined
Face to face	Planning	3	6	9
	Training	0	7	7
Remote support	Building	12	19	31
	Testing	10	10	20
	Deployment	3	7	9
	Data management / monitoring	1	16	18
Total		29	65	94
	Travel costs	6		

Conclusion and key lessons

The adoption of MAD was a great success for the project in terms of time saving during data collection and analysis. While the time cost to researchers was high, additional experience would likely minimise the issues that exacerbated this resource drain.

An estimated total of 1250 ‘enumerator days’ were saved by adopting MAD technology in deployment alone. This figure is based on an average of 2 hours saved per interview (reported by the project), over 5,000 interviews with each enumerator working 8 hours per day. This time saving was also passed on to respondents who spent two hours less in participation time. Therefore, in a research activity of this scale the benefits of MAD were very clear. Below are some key lessons from this project case study:

- When involving third party app builders it is critical for researcher teams to have **access to the development project space** for quality assurance and to ensure on-time delivery. It is worthwhile to invest in planning meetings to communicate project requirements in detail.
- Professional enumerator companies may have policies that will affect app workflow and structure. **Engaging enumerator companies during the planning phase** is ideal so their input can be solicited when the app is being designed.
- Having **researchers with extensive general technical and statistical analysis experience** acting as app managers for the project and third-party app

development made shorter lead times possible for this project, with no specific training necessary for the team.

- The need for **early participation of all project stakeholders** in reviewing the application from the perspectives of research optimisation, fidelity and localisation is a key learning here. Project workshops are the ideal time to schedule these reviews and timelines should be negotiated with this in mind.
- The choice of the field supervisor to **use an internet messaging group** to communicate with enumerators was enthusiastically adopted and showed that having mobile devices in the field has benefits beyond MAD.

7.1.2 Pakistan Dairy

Key points

Project Title: Improving smallholder dairy and beef profitability by enhancing farm production and value chain management in Pakistan

Project code: LPS/2016/011

Location: Punjab and Sindh provinces, Pakistan

Systems studied: Smallholder dairy and beef production within mixed crop-livestock systems

Research Activities: Meetings and discussions with potential partner organisations for scale-out activities of whole-family extension approach. Desktop survey for initial evaluations of organisation's management and objectives in extension. Review of current dairy-beef value chain literature in Pakistan. Value chain actor interviews to map beef value-chain of Punjab and Sindh. Review current understanding and efficiency in the dairy and beef operations on smallholder farms.

Lead Institution: University of Melbourne, Australia

Partner institutions:

Pakistan: University of Animal and Veterinary Sciences (Lahore), Sindh Agriculture University

Australia: University of Melbourne, Charles Sturt University,

Disciplinary focus: Value chains research, extension and adoption

Project stage for MAD implementation: First year of a four- to five-year project

Level of research staff experience with MAD: Project leader had one year of MAD experience, research staff were new to MAD

MAD activities: Survey of value chain actors (farmers, processors & NGOs), monitoring and evaluation of partner organisation extension activities, tracking farmer adoption after extension program implementation.

MAD feedback mechanism: Surveys provided comparison of farmer-responses with baseline data collected in a previous project. Extension advice for different farmer responses was also pre-programmed into the MAD application and was provided during data collection.

Key lessons:

- Allowing project teams (including at least one in-country) time to work together to learn application building under basic guidance helps to build local capacity and places emphasis on their understanding of how MAD applies to their work/research.
- Important to have clear targets about what is needed in app design otherwise the building process is drawn out.
- Start small with one or two builds and data collection activities and take the team through the whole process. This will help to build confidence/understanding.

Project background

This dairy and beef project worked in the provinces of Punjab and Sindh (Pakistan) to improve the profitability of farm and animal production. It did this through developing market and value chain opportunities. Building on a 10-year long engagement with the dairy sector through the Australia Pakistan Agricultural Sector Linkages Program (ASLP), the project aimed to scale out its extension model by enlisting a broad range of local collaborating organisations.

More information on this project can be found on the ACIAR website (http://aciar.gov.au/project/lps/2016/011)

Perceptions and previous experience of MAD technologies

The project leader Dr David McGill had previously been a lead researcher on the MAD Bali Pilot (MAD 1). He therefore had the most experience with CommCare of any project leader in the MAD 2 series. The project staff did not have previous experience with CommCare but were excited by the prospect of MAD adoption. Dr McGill had concerns around the data security and ethics, as well as the possibility the MAD implementation would lead to excessive data collection (Table 8). The in-country project leader was most concerned about hardware issues, while the app manager also felt concerned about data security and excessive collection, as well as potential problems with internet connectivity (Table 8).

Table 8: Perceptions of various Pakistan Dairy project staff on issues relating to adoption of MAD in their project. Data collected through baseline perception surveys at the beginning of the SRA.

Issue	**Research Project Manager (ACIAR)**	**Project Leader (Australia)**	**Project Leader (Pakistan)**	**App Manager**
How do you rate your concerns around using apps in relation to the following issues?	*(On a scale of 1-5: 1= not concerned: 5= very concerned)*			
Data Security	1	4	1	4
Excessive data collection	3	4	3	4
Data ethics & use	2	4	2	1
Costs to projects	1	0	1	1
Data ownership (in country partners)	1	1	1	1
Hardware reliability	1	1	5	1
Language	1	1	2	1
Internet coverage & reliability	2	1	2	5
Cumulative totals (/40)	12	16	17	18

MAD Activities and support provided

In contrast to the adoption approach favoured by other projects in the MAD series, this team were able to build MAD capacity internally through trial and error and minimal external support. This was largely due to Dr David McGill's existing experience with MAD allowing him to lead the project staff in mostly self-directed training without AgImpact support. The project also received additional separate funding from ACIAR for a scoping study into CommCare implementation (C2016/043). As a result, AgImpact support was less focused on training and much more so on planning and broader architecture of MAD implementation.

Within the Pakistan Dairy project, the capacity for the CommCare platform to be used as both a data collection system and as an extension tool was trialled.

MAD Activities

The project built two application(s): one for mapping out value chain actors in the beef-value-chain (deployed during the SRA) and one for tracking research and extension activities by partner organisations (built but not deployed during SRA). This second application was designed to be used during a scale-out phase to monitor activities of each actor in the value chain and their teaching, learnings and adoption. In addition, a final activity was the conversion of one printed extension factsheet into a digital/electronic format in CommCare. This factsheet represented one module in a 10-module extension program, the remainder of which remained to be digitised at the completion of the MAD 2 SRA. This initial digitised factsheet was deployed as a static digital sheet and as an interactive application, along with traditional printed sheets and evaluated for its ability to engage farmers.

During the development of these applications, the Pakistan Dairy team evaluated the automatic CommCare translation service for Urdu. Finding it unreliable, the team then devised a new method for translating CommCare applications into Urdu through trial and error with several other services (e.g. Google translate). This was undertaken by the in-country team in a self-directed manner.

Planning

Early planning of how to implement MAD was undertaken by Dr David McGill in consultation with AgImpact. In this meeting ideas for how to use CommCare in the project were brainstormed, with specific discussion around using the platform to collect data from recruited partner organisations. It was decided that initial MAD adoption would focus on building an application for the Value-Chain-Actor survey. A discussion also took place around the possibility of using CommCare as an interactive extension delivery tool with farmers.

A further face-to-face session was held with the in-country project team and AgImpact staff. During this meeting, it became evident that the project staff already had ample capacity in basic CommCare application building, but that consideration of how to apply these skills into a well-designed application had not yet taken place. Allocated training days were therefore spent assisting refining the Value-Chain Survey MAD application which had already been partially built. This consisted of considering best design practices and overall architecture for effective MAD implementation. Training in more advanced features such as 'case management' was also provided. The project team requested that the remaining AgImpact support time be dedicated toward assistance in Testing and Deployment (5 days), and Monitoring and Evaluation (10 days).

A third planning meeting between Dr McGill, AgImpact and ACIAR staff was held later in the project to assist in the design of a MAD extension evaluation study. Advice was provided by AgImpact on how to design data collection during this extension delivery

study to evaluate different users (i.e. research staff, inexperienced field staff, experienced field staff).

Training & Building

As discussed, training was mostly self-directed by the in-country team with initial guidance from Dr McGill and virtually no support from AgImpact. This distinguished the Pakistan Dairy project from others in the MAD 2 SRA, but successfully led to the development of capacity in CommCare. This led to much of the value chain survey being built by the in-country team in a piecemeal manner during self-directed training. AgImpact was requested by Dr McGill to provide face-to-face training on higher-level application design and architecture, as well as more advanced features of CommCare. The training outlined features such as 'case management', but most of the allotted training time was spent assisting the team in planning and application design. This successfully paved the way for more fruitful discussions between the project lead and app builders on the intended purpose of the data being collected, as well as the trade-off between in-depth data collection and enumerator and farmer fatigue. After this process, the in-country project team completed the value-chain survey application. The in-country team were able to develop the app well, though encountered a significant challenge during the translation from English to Urdu.

The translation of English extension materials into Urdu was completed on CommCare by project staff in Pakistan without assistance from the project lead or AgImpact. This was achieved through a trial and error approach which began by using CommCare's inbuilt translation function before attempting various other approaches and finally settling on a Unicode software that could translate Urdu into machine-friendly symbols. This task was particularly time consuming, with a total of 15 project staff days spent on it.

Testing & Deployment

Testing of the initial value chain survey forms built by the project staff was performed with the presence of AgImpact. Forms were tested with farmers in Pattoki, and challenges or issues with the application questions were noted for discussion and / or revision. This testing process allowed for more sophisticated planning by the in-country team for the remaining forms in the value chain survey which had not yet been built.

Deployment of the value chain survey application was managed in-country by the app-building team with little assistance from Dr McGill. Field staff collected basic data using the application and supplemented these with more detailed data which were recorded on paper. No application issues were reported to the project lead during deployment, though Dr McGill noted that the forms being deployed used only the most basic aspects of CommCare so their success may be attributed to the simplicity of the app.

Deployment of the digitised extension factsheet (both in static digital form and an interactive form) along with the original printed sheet was conducted in the form of a field study in extension delivery. Three extension teams each consisting of five individuals each (a mix of researchers, experienced field staff and new field staff) were sent to deliver extension materials. Each group was given one of the three formats (traditional printout, static digital app, interactive digital app) and delivered the information to farmers. All enumerators were then surveyed to measure their perceptions of farmer engagement.

Monitoring and Evaluation

While the value chain survey application was being used on a daily basis, the project lead was able to check the data and monitor their quality. When any data were unclear, Dr McGill called the team directly to clarify any issues. At the completion of the SRA, the project team had plans to develop more monitoring and evaluation of data and app usage.

User experiences

Research staff

Pakistan Dairy had the highest response rate to the ongoing feedback mechanisms put in place to capture user experiences in the MAD 2 SRA. The forms were completed a total of 41 times by project staff, providing an excellent dataset on both the nominated difficulty of MAD implementation phases and the value of various support mechanisms provided. Responses showed project staff were most likely to find all phases of MAD implementation 'Normal' in their difficulty compared with their usual work (Figure 4). However, a substantial number of responses indicated training, building and testing to be 'Difficult'. Deployment and Data Monitoring & Evaluation were the only phases that any staff nominated as 'Very Difficult'. The most common support mechanism utilised by project staff was the CommCare Support Page, which was nominated as 'Useful' in the majority of responses (Figure 5). Those project staff receiving AgImpact support or support from other ACIAR projects found it to be either 'Useful' or 'Very useful'.

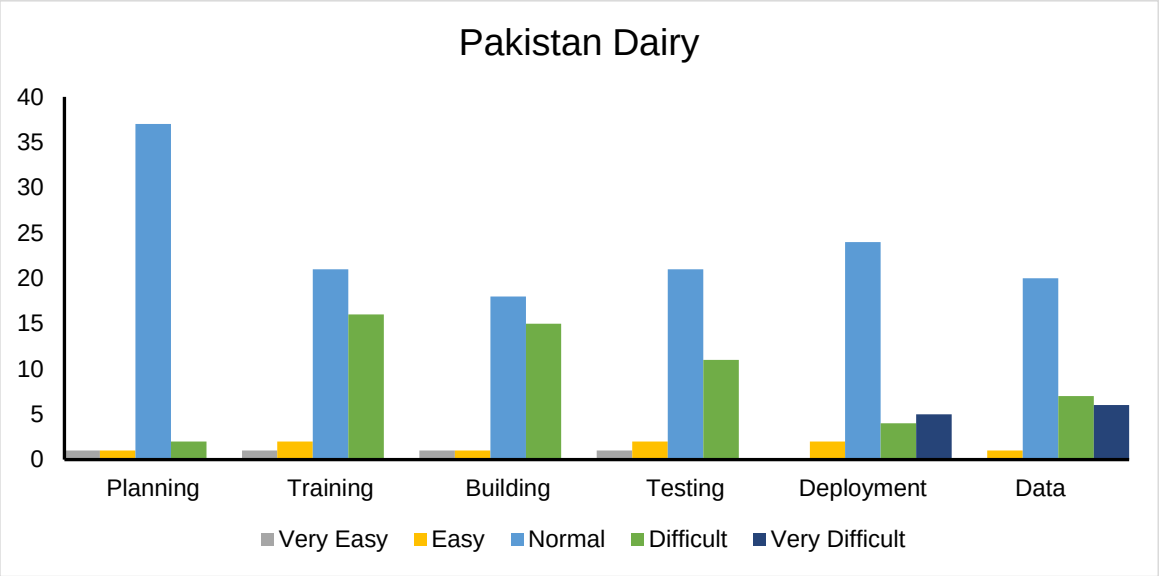

Figure 4: Ratings on the difficulty of various phases of MAD implementation from Pakistan Dairy project staff. Total number of responses = 41. Responses recorded as 'Not Applicable' are not shown.

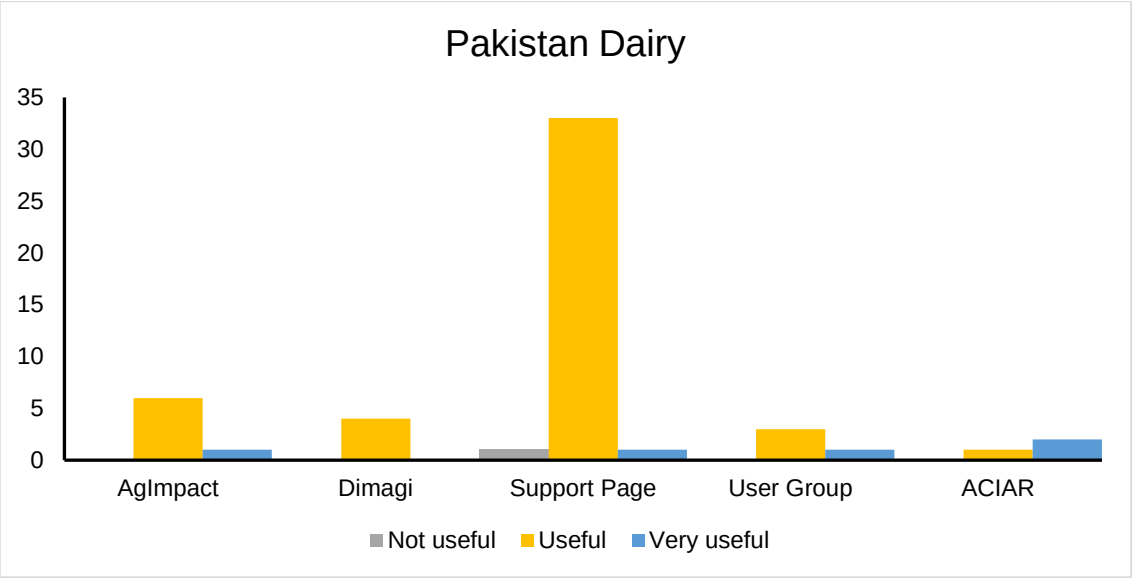

Figure 5: Feedback from Pakistan Dairy project staff responses on the value of various support provided during the MAD 2 SRA. Responses recorded as 'Not Applicable' are not shown.

Enumerators

Baseline and endline enumerator surveys indicated extension staff conducting MAD surveys had more scepticism that they would change the relationship between themselves and the farmers. However, after completing fieldwork, most (80%) agreed that it did change this relationship. In contrast, proportionally fewer research enumerators felt apps would change the relationship between enumerators and their supervisors (Table 9). While research enumerators all believed data quality would be improved, the proportion of extension enumerators in agreement with this statement increased from 70% to 90% after fieldwork (Table 9). All enumerators believed MAD technology would make surveys faster and easier to complete both before and after the fieldwork.

Table 9: Pakistan Dairy enumerators' perceptions of the role of MAD apps in data collection. Results shown include baseline and endline comparisons.

Survey question	Component	Baseline result	Endline result	Change
Survey responses (n)	Extension	10	10	0
	Research	5	9	+ 4
Believe apps change interviewer-farmer relationship (%)	Extension	40	80	+40
	Research	100	89	- 11
Believe apps change supervisor-interviewer relationship (%)	Extension	100	100	0
	Research	80	100	+20
Believe apps make conducting surveys easier (%)	Extension	100	100	0
	Research	100	100	0
	Extension	100	100	0

Believe apps make surveys faster to complete (%)	Research	100	100	0
Believe apps collect data more accurately (%)	Extension	70	90	+20
	Research	100	100	0

What were the benefits?

The main benefit of MAD adoption in this project was that it gave the team a platform which could be used to discuss the future of data being collected. The project was able to visualise what the data would look like and then consider how it would be used during analysis. Conversations around the depth of questioning, the enumerator comprehension and the scale of the collection (i.e. the time it takes to complete a survey) all took place between staff. These led to revisions in the survey instrument as well as valuable lessons in research design for all researchers involved. The project lead Dr McGill stated that surveys on paper simply don't provide the same catalyst for such discussion.

Another key benefit was the sense of ownership among in-country staff of the research process. The 'light touch' approach by Dr McGill in training and application building allowed the in-country staff to have more confidence in tackling data analysis. This was due to their time investment into planning the analysis during application building. Having access to the data through CommCare HQ also meant the team did not need to get the datafiles directly from the project lead, saving time.

What were the challenges?

While the Pakistan Dairy app builders were able to master the basic CommCare functions, they had less opportunity and success working with more advanced features. The main application for value chain surveys consisted of very simple forms. Dr McGill suggested that a renewed time investment from the team would be needed to master these more advanced features. This would not be possible through purely self-directed learning and would require a more hands-on management approach from either the project lead or AgImpact.

One challenge faced during the building of the 'simple' value chain survey application was the translation into Urdu. Dr McGill noted that more assistance from management may have saved time on that task but the team sought to resolve the issue themselves and did not seek out help.

Another challenge was that the team spent a great deal of time in self-directed training and without a clear design plan or direction. This meant that time taken to build the value chain survey was much greater that it needed to be. Part of the reason for this was also that the project lacked urgency as there was ample time between initial building and deployment. Other projects with tighter timelines were able to build faster in-part because of greater urgency.

Financial and time costs involved

Operational costs

A total of $2,200 was reported by the Pakistan Dairy project. These operational costs were used to purchase tablets for the team to collect MAD in the field.

Time costs

This project differed from most in that little support time was provided by AgImpact whereas a great deal of amount of time was spent by project staff on MAD

implementation. A total of 5 support days were provided to the Pakistan Dairy project by AgImpact. While three of these days were logged as 'training' (Table 10), due to the high CommCare capacity among the project staff, training was mostly focused on high-level planning. The Pakistan Dairy project staff logged a total of 210 days on MAD implementation. Most of this time (79 days) was spent on planning, with training (39 days) application building (53 days) also using a lot of staff hours (Table 10).

Table 10: Time spent (days) by AgImpact staff (support) and Pakistan Dairy project staff (implementation) in each phase of MAD implementation.

Support type	Activity	AgImpact staff (days)	Pakistan Dairy staff (days)	Combined
Face to face	Planning	2	79	81
	Training	3	39	42
Remote support	Building	0	53	53
	Testing	0	20	20
	Deployment	0	12	12
	Data management / monitoring	0	7	7
Total		5	210	215
	Travel costs	3.9		

Conclusion and key lessons

The Pakistan Dairy project was an excellent example of how strong in-country capacity can be developed through investing time into learning new app building skills and allowing a certain degree of autonomy and self-direction for app builders. At the same time, the project experience adopting MAD technologies also highlights the inherent trade-off between self-direction (allowing local ownership) and clear instruction (saving time and avoiding a meandering building phase). The optimal balance between these two approaches can also change over time throughout the project, as needs evolve and MAD tools are deployed.

Preliminary results from the extension delivery study using CommCare showed that it has enormous potential for improving the farmer learning and thus increasing adoption of best practices. This initial study was set to expand beyond the timeline of the MAD 2 SRA, and remains the favoured MAD activity by the project lead.

Other key points from this case study are:

- **Investment in training**, where possible, is extremely beneficial.
- It's much easier to run MAD implementation (from afar) when you know the **local team have the time and capacity** to complete the MAD implementation tasks.
- Time is critical. Project managers are generally time poor whereas **in-country team members may have more time to learn the new technical skills** and go through the process of deployment.
- Use of CommCare results in **better data, but training of field staff is critical** to the success of data collection

- **Using data as they're collected** can allow early identification of issues in survey instrument design

7.1.3 Vanuatu Beef

Key Points

Project Title: Increasing the productivity and market options of smallholder beef cattle farmers in Vanuatu

Project code: LPS/2014/037

Location: Espiritu Santo, Vanuatu

Systems studied: Smallholder beef production

Research Activities: On- and off-farm participatory research, demonstration and training, livelihoods and production systems monitoring

Lead Institution: The University of Queensland

Partner institutions:

> Australia: Queensland Department of Agriculture, Fisheries and Forestry, Australian Ministry of Agriculture, Southern Cross University
> Vanuatu: Ministry of Trade, Commerce, Industry and Tourism, Vanuatu Agricultural Research and Training Centre, Vanuatu Agriculture College, Ministry of Agriculture, Livestock, Forestry, Fisheries and Biosecurity

Disciplinary focus: Multidisciplinary; Livelihoods analysis, cattle economics and value chains, cattle and forage production

Project stage for MAD implementation: 1st year of a 4-year project

Level of research staff experience with MAD: High technical capacity among researchers but untrained in MAD at the commencement of adoption

MAD activities: Small scale (36-100 households) livelihoods survey (baseline/endline), farm systems survey (baseline/endline), longitudinal cattle production monitoring was developed with a 2-month lead time.

MAD feedback mechanism: Informal phone conversations and emails, printouts of cattle information sheets for farmers.

Key lessons:

- It is important to consider practices in the field when designing application workflows
- Building in real time smallholder feedback strengthens the relationship between enumerators and smallholders and improves local perceptions of the project
- Difficulties in linking data between forms and cases can result from major changes to application structures after collection starts and a lack of real-time data monitoring
- Benefits of MAD are more obvious at scale (e.g. time saving increases with more fieldwork and longer surveys), but smaller scale projects could maximise benefits of MAD by selecting key parts of their data collection for MAD implementation
- Face to face intensive training is an effective method for rapid upskilling in app building

Project Background

This project aims to increase the productivity and marketing options of smallholder cattle farmers in Vanuatu through social, business and production participatory research, demonstration and training activities. The project was managed by the University of Queensland with components led by Dr Simon Quigley, Dr Cherise Addinsall and Dr Scott Waldron.

The specific objectives are:

1. Describe the economic, policy and social settings within which smallholder cattle farmers operate and their livelihood objectives and strategies
2. Sustainably increase beef production of smallholder households through change in on-farm management practices
3. Increase the returns to smallholder cattle farmers through whole-farm and cattle enterprise economic analysis, business training and marketing interventions
4. Create pathways to sustain and extend project outcomes and impacts beyond the scope of the current project.

More information about the overall project can be found on the ACIAR website (http://aciar.gov.au/project/lps/2014/037).

Perceptions and previous experience of MAD technologies

The Vanuatu beef project researchers had no prior experience with MAD, though they had a very high aptitude for learning application building concepts. Project Lead Dr Simon Quigley was initially concerned about technology dictating the type of data that was collected, and that mobile devices might distance field staff from comprehension of the data. He also expressed concern with the potential cost of MAD implementation (Table 11). However, there was enthusiasm about the potential time savings in data entry, remote accessibility of data, and the potential for the technology to attract youth to be involved with the project. App managers working on the project were concerned about data (security, use and ownership), hardware and internet reliability and language barriers (Table 11).

Table 11: Perceptions of various Vanuatu Beef project staff on issues relating to adoption of MAD in their project. Data collected through baseline perception surveys at the beginning of the SRA.

Issue	Research Project Manager (ACIAR)	Project Leader (Australia)	App Manager	App Manager	App Manager
How do you rate your concerns around using apps in relation to the following issues?	*(On a scale of 1-5: 1= not concerned: 5= very concerned)*				
Data Security	1	3	5	4	3
Excessive data collection	3	1	3	1	3
Data ethics & use	2	3	4	5	2
Costs to projects	1	4	2	3	4
Data ownership (in country partners)	1	2	4	4	1
Hardware reliability	1	1	4	5	2
Language	1	1	3	4	2
Internet coverage & reliability	2	3	3	5	3
Cumulative totals (/40)	12	18	28	31	20

MAD Activities and support provided

MAD Activities

A rolling baseline study including village, household, household member, farm and cattle registration was conducted with 36 households in the first year. This scaled to 100 households by the third year of the project. Cattle weight, class and body condition were monitored bi-monthly. The endline survey utilised the same forms developed for the baseline. Some routine activities like faecal collection and management of project enquiries were incorporated into the application. An early decision was made that the economic component would utilise in-depth, unstructured interviews with note-taking on paper as the method of data collection, rather than MAD.

Support included 3 face-to-face intensive sessions:

i. A 4-day training in app building;
ii. A 2.5-day refinement workshop; and
iii. A half-day data management tutorial.

Assistance was given in creating an auto-updating feed of the raw data in Excel for the livelihoods component. Very little remote support was required, and when it was it consisted mostly of emails between project staff and AgImpact support.

Planning

A small proportion of the paper questionnaires had been field tested at the commencement of MAD adoption. Dr Quigley approached Dimagi, the creators of CommCare, for advice about a basic architecture for the app and AgImpact developed this structure further. The structure was expanded in the first day of the app building training, and refined over the remainder of the session. Decisions were made about what should be included from the paper surveys, what important questions were missing and what constituted excessive data collection. A timeline was also developed during the training that set back the time to deployment from 6 weeks to 2 months.

Training & Building

The CommCare application was built entirely by the researcher team (Dr Quigley and Dr Addinsall) who had previous attended the Masterclass run by AgImpact and therefore was exposed to CommCare. Sixty-percent of the build was completed during the initial Vanuatu Beef project training. Minimal remote support was required for them to finish the app to field-readiness. A significant level of data confirmation and validation was implemented in the forms.

With five field staff acting as enumerators, only a single day of classroom-based enumerator training and MAD familiarisation was required before supervised data collection began.

Testing & Deployment

Testing for desktop functionality and design was also conducted by the researcher team. Heavy refinement and structural reorganisation of the app was undertaken in the field, while the baseline was ongoing, and in follow-up training. Modules for smallholder feedback were added during the second workshop, including the ability to present a list of cattle with current market values through two sales channels. At the end of the MAD 2 SRA, the application consisted of 28 short to medium length forms organised into nine separate modules.

Supervised data collection began shortly after enumerator training. The researchers observed data collection during the day, and fixed issues and refined the application at night. Through this process it was quickly discovered that the interviews were taking much longer than expected. As a result, some forms and sections were removed from the application. After this initial phase, data collection continued unsupervised in between subsequent researcher field visits.

Monitoring and Evaluation

Data monitoring was undertaken in the field (by examining data saved to the devices) and remotely (by downloading the data in Excel format). During remote monitoring, feedback on data quality was communicated from the research team to the enumerators by phone. Data manipulation and reformatting in Excel was required to match incoming data with legacy data formats from the original app structure.

An innovative method of in-field evaluation and feedback was developed during this project. Using calculations based on stored data and displayed on the tablets, on the spot, tailored management advice was given to participants. Games were developed to compare a farmer's estimated value for his cattle with the real-time calculated value using cattle weights and up-to-date market information.

User experiences

Research Staff

Staff in the Vanuatu Beef project found the planning and training phases of MAD implementation either ‘Easy’ or ‘Normal’ (Figure 6). However, staff members often found application building and testing ‘Difficult’. Many found deployment work to be an ‘easy’ or ‘normal’ task while the few staff that did data management and monitoring found varied in their experience recording it as either ‘Normal’, ‘Difficult’ or ‘Very Difficult’.

AgImpact support was mostly regarded as ‘Very useful’ by project staff, with most other support provision being rates as ‘useful’ (Figure 7).

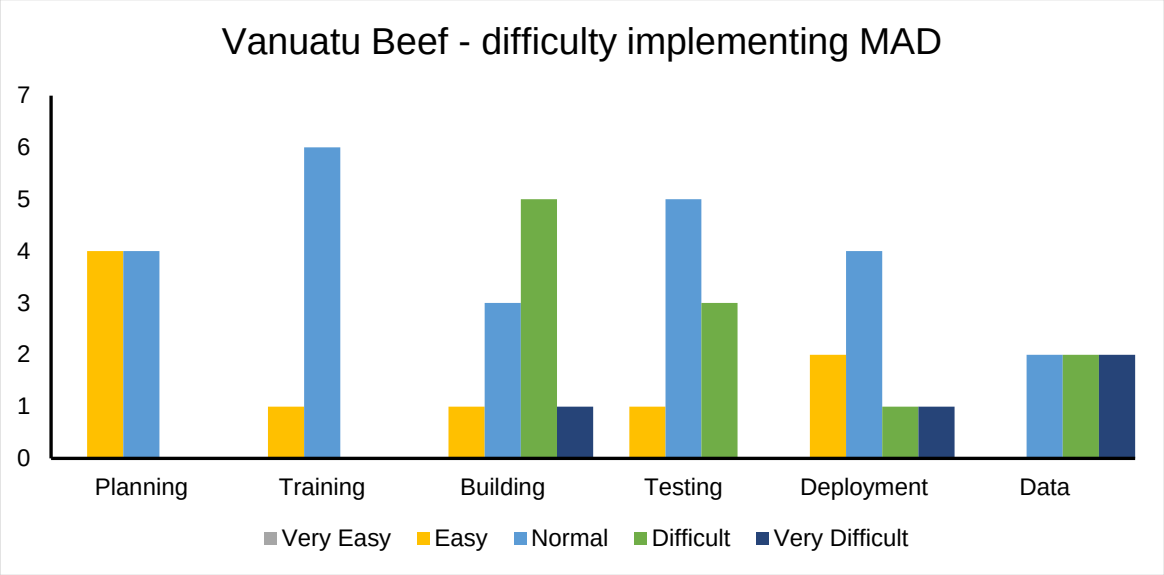

Figure 6: Difficulty rating by project staff of the work involved in each phase of MAD implementation. Total of 18 responses recorded. Responses recorded as 'Not Applicable' are not shown.

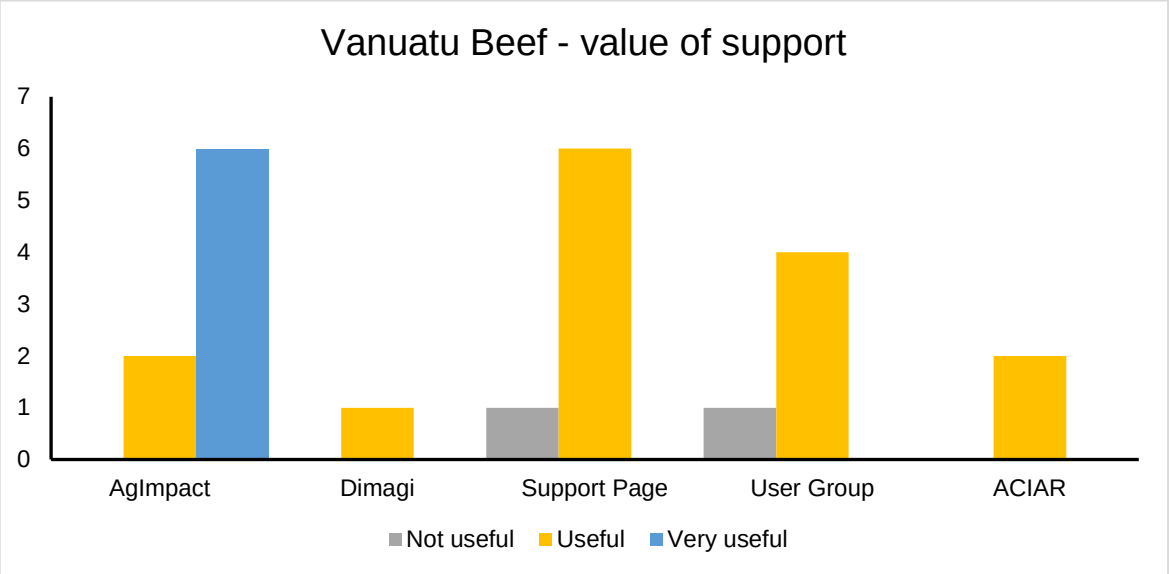

Figure 7: Feedback from Vanuatu Beef project staff responses on the value of various support provided during the MAD 2 SRA. Responses recorded as 'Not Applicable' are not shown.

Enumerators

Baseline and endline surveys of enumerators showed confidence among this small team in MAD applications potential to change interviewer-farmer relationships and improve the survey experience (Table 12). Almost all respondents (80%) believed interview-farmer relationships would change from using MAD applications before fieldwork, and all agreed

with this after it was completed (Table 12). All believed that MAD apps would make it easier to conduct surveys and reduce the time needed to do so both before and after fieldwork. While only 60% believed apps would lead to improved accuracy of data collection before fieldwork, this increased to 80% afterwards.

Table 12: Vanuatu Beef enumerators' perceptions of the role of MAD apps in data collection. Results shown include baseline and endline comparisons.

Survey question	Baseline result	Endline result	Change
Survey responses (n)	5	5	0
Believe apps change interviewer-farmer relationship (%)	80	100	+20
Believe apps change supervisor-interviewer relationship (%)	80	80	0
Believe apps make conducting surveys easier (%)	100	100	0
Believe apps make surveys faster to complete (%)	100	100	0
Believe apps collect data more accurately (%)	60	80	+20

What were the benefits?

MAD implementation in the Vanuatu Beef project led to benefits for the participants, field staff, research staff, data quality, and community perception of the project.

Relationship with participants and community

The clearest benefit to the project in adopting MAD was related to the use of in-form calculations and data tabulation on the device. These provided smallholders with on-the-spot printed information showing individual animal weight change and current market values across the herd. Both researchers and field staff commented that this activity improved the relationships with smallholder participants, and perceptions of the project in the community.

Smallholders also indicated that they were making farm management decisions immediately based on the real-time market value information. They expressed disappointment that local extension officers in the area had used paper and never provided them with feedback.

Field staff experience

Field staff were particularly enthusiastic on this point, with 100% of them feeling that their relationship with farmers had changed for the better through the use of MAD. Eighty-percent said that their relationships with their supervisors had changed for the better. One hundred percent believed the app was easy to use, and their jobs had been made easier and faster by the introduction of the new technology. Eighty-percent felt that the data collected was more accurate compared to data collected on paper. The fieldwork coordinator on Santo Island appreciated the opportunity to debrief with the project leader over the phone when the day's data had been reviewed.

Research staff

In choosing to develop, test and maintain the application with limited support, the project leaders gained skills and experience in programming MAD apps they expect to use in future projects.

Data quality

The app added value in automating the field scale checks. Calculations were included to determine and advise if the degree of variability versus bathroom scales was significant enough that a recalibration was necessary.

Interdisciplinary collaboration

Building the application together changed the way the researchers communicated with each other and fostered collaboration and interdisciplinarity. Owing to the fact that the various surveys were being delivered on one platform, the livelihoods and production sides of the research team were brought closer. This included each side providing comment on each other's survey sections, especially at the planning stage. In that sense, the MAD implementation helped increase interdisciplinary collaboration within the project.

What were the challenges?

Time requirements

With the lead researchers taking on all the responsibility for implementation, MAD implementation was a time-expensive exercise for the project. A total of 75 days was spent on MAD activities between the two component leads who participated (Table 16). While time spent on traditional data entry to Excel spreadsheets was saved, this was estimated to have usually taken two-months (less than 75 days), this data entry could have been done by field staff. That meant that there was a net loss in research staff time from adopting MAD.

Design issues

Some of the structural design choices made during the initial development were not practical under field conditions. The use of a single form with looping sections for cattle registration was discarded by the second training in favour of a 1 form per animal approach. This change reduced the potential for data loss. It also helped to manage situations where animals owned by different farmers were penned at the same time and herding an individual farmer's cattle through in sequence wasn't possible. Manually entered cattle ear tag IDs were replaced with app-generated tag IDs based on the farmer's initials.

In the livelihoods component, forms that were initially being used at the household level needed to be linked to individual household members, to get a gender disaggregated perspective on some issues.

These alterations meant quite a lot of work was needed to amend the forms and application structure. Linking existing form data to respondents required a different approach to that taken with data collected after the changes were implemented. This was particularly so in the case of the livelihood component changes.

Shifting focus of staff

Dr Quigley felt that the focus on the devices and app during training meant that less emphasis was placed on the biological aspects of field staff skills. He suggested that other research related skills, like data entry and presentation in Excel, had been supplanted by the MAD implementation. He remained concerned that the centralisation of data storage was limiting field staff's understanding of the farmers and animals, but felt this could have been minimised by prioritising the creation of a data dashboard to share with team.

Device issues in the field

It was discovered that the screens could become unresponsive when wet, and there was no shelter where cattle were being weighed. To resolve this the enumerators were supplied with rain covers for the devices.

Financial costs involved

Operational costs

A total of AUD $5,495 was reported as the cost of implementing MAD for the Vanuatu Beef project. As well as mobile devices - the team used Samsung and ASUS tablets - this included the cost of rain covers to ensure device functionality in wet weather. The cost associated with AgImpact support was covered by ACIAR as part of the MAD 2 SRA and therefore was not covered by the Vanuatu Beef project.

Time costs

A total of 14 support days were provided by AgImpact to Vanuatu Beef (Table 13). Most of this support was in the form of face-to-face planning and training. An additional 8.1 days were logged for travel and logistics.

The project staff themselves spent a total of 75 days on MAD implementation. Most of this time was spent during training, building and testing (Table 13).

Table 13: Time spent (days) by AgImpact staff (support) and Vanuatu Beef project staff (implementation) in each phase of MAD implementation.

Support type	Activity	AgImpact staff (days)	Vanuatu Beef staff (days)	Combined
Face to face	Planning	2	8	10
	Training	7	15	22
Remote support	Building	0	27	27
	Testing	2	14	16
	Deployment	1	5	6
	Data management / monitoring	2	6	8
Total		14	75	89
	Travel costs	8.1		

Conclusion and key lessons

The project component leads felt that though they dedicated a lot of time to MAD adoption, and experienced quite a few logistical issues in the field. However, the lessons learned through this implementation experience will be invaluable when applied to future projects.

Dr Quigley and Dr Addinsall proved that with just a few days training it is possible for researchers to build and deploy a large MAD application utilising sophisticated features.

Most importantly, some of the innovative features they employed progressed the goals of the project and transformed the way farmers in the region think about participating in

research. These features should serve as a model for feedback loops in MAD-capable projects.

There is a trade off in skills (i.e. in data management by field staff) when adopting MAD technology that project leads should be aware of. Despite this, strategies exist for minimising any disconnect between field staff and the data. Further lessons learned through this project include the following:

- Designing a suitable MAD application requires giving **a lot of consideration to field conditions**, particularly the logistics involved when working with animals.
- Closing the feedback loop by **utilising calculations to provide valuable real-time information to farmers** has a very positive impact on smallholder relationships in research projects
- There is value spending **extra time at the planning stages**, and in field testing an application before real data is collected, in order to minimise changes that could result in legacy data structures
- Projects with in-depth, small scale data collection requirements may not see the time savings that can be expected at scale, but should consider **partial MAD adoption** for components that conduct regular monitoring
- **Training workshops of 3 or more days** are a viable method for upskilling researchers who would like to develop and deploy applications themselves

7.1.4 MyRice

Key Points

Project Title: Diversification and intensification of rice-based systems in lower Myanmar

Project code: SMCN/2011/046

Location: Ayeyarwady delta, Myanmar

Systems studied: Smallholder rice production

Research Activities: Household surveys, benchmarking farmers' fields and establishment of best practices, on-farm rice and rice-pulse trials, and postharvest management training.

Lead Institution: International Rice Research Institute, Philippines (IRRI)

Partner institutions:

Myanmar: Department of Agriculture, Department of Agricultural Research

Disciplinary focus: Agricultural Economics and Social Science

Project stage for MAD implementation: Extension year (4) of 3-year project

Level of research staff experience with MAD: Experience with 2 MAD platforms, SurveyBe and CSPro, prior to training in CommCare app building

MAD activities: 250 x farmer data sheet (high level endline), 250 x household survey (in-depth endline), monitoring of participation in farmer training and meetings

MAD feedback mechanism: In-country researchers reviewed the information daily and debriefed in person with enumerators.

Key lessons:

- Community of practice training and activities are effective for the scaling out of MAD skills within an institution.
- Embedded calculations in apps increase the speed of data analysis and provide valuable feedback to farmers.
- Surveys developed for one project can become a structural template for use in similar projects.
- Large surveys should be broken down by topic into multiple forms for targeted testing and to minimise the risk of data loss.
- For complex surveys built by relatively inexperienced app builders a long lead time is required to allow for adequate testing, and changes should be avoided close to deployment.

Project Background

The MyRice project aimed to improve farmer profitability through developing best practices for rice production, including post-harvest management. The project also aimed to develop innovative approaches to make rice-pulse cropping systems more productive. The project was managed by Dr Grant Singleton with MAD activities coordinated by Ms Arelene Malabayabas.

More information about the overall project can be found on the ACIAR website (http://aciar.gov.au/project/smcn/2011/046).

Research activities

This project included a needs assessment conducted in 16 villages. Baseline household surveys were conducted with 25 households in 8 villages (n = 200). Farmer practice and performance in summer rice cropping was assessed to establish local best practice (i.e. alternate wet and dryings, nutrient management, herbicide use, direct seeding). Weeds in summer pulse systems were also monitored for their impact on production. On-farm field trials were established at 8 sites in each participating township. Agronomic and varietal selection trials were run throughout the project at these sites. A postharvest loss assessment trial was also conducted. Finally, postharvest management training was provided to local extension officers, NGO staff, farmers, rice millers and research staff.

Perceptions and previous experience of MAD technologies

The team of social and economic scientists involved in the MyRice project had previously conducted research using digital data collection platforms SurveyBe and CSPro. With SurveyBe the team were able to develop the application themselves. However, they found the platform expensive, prone to crashing and the data format was difficult to work with for analysis. CSPro application development was completed by a consultant programmer because the research group did not have the required skills. Outsourcing to a consultant made changes a time-consuming and expensive process, and the researchers were not satisfied with the final product.

Dr Grant Singleton already had substantial experience with MAD and a comprehensive understanding of the benefits and issues that could be expected. He was most interested in the immediacy of feedback to smallholders and the validation features available in mobile applications. His concerns regarded how quickly the applications could be built and whether they would be easy for enumerators to use in the field. He was also concerned about excessive data collection and data ethics and use, as well as language barriers and internet connectivity (Table 14). One benefit he hoped to see specifically from the MyRice team's involvement in the MAD SRA was the beginning of a consistency in data collection format across multiple IRRI projects. App manager Su Su San had similar concerns to Dr Singleton, but was additional wary of the potential costs to the project from adopting MAD technologies (Table 14).

Table 14: Perceptions of various MyRice project staff on issues relating to adoption of MAD in their project. Data collected through baseline perception surveys at the beginning of the SRA.

Issue	Research Project Manager (ACIAR)	Project Leader (Australia)	App Manager
How do you rate your concerns around using apps in relation to the following issues?	*(On a scale of 1-5: 1= not concerned: 5= very concerned)*		
Data Security	2	3	2
Excessive data collection	1	5	1
Data ethics & use	3	5	4
Costs to projects	4	2	4
Data ownership (in country partners)	3	1	1
Hardware reliability	1	3	1
Language		4	4
Internet coverage & reliability		5	5
Cumulative totals (/40)	14	28	22

MAD Activities and support provided

MAD Activities

Smallholder data collected in the MyRice baseline surveys was imported into CommCare to eliminate redundancy and avoid the need for farmer registration in the new application. Two applications were developed in CommCare for this project: one with 3 short forms to capture high level, 20-minute interviews for the farmer data sheet (2.5 months lead time), and one application for in-depth 1.5 hour household survey interviews (6 months lead time). The household survey application was similar to the project's paper baseline questionnaire. As an application, it consisted of 15 forms on topics ranging from land preparation to post harvest practices. Finally, the team adopted a generic application built by AgImpact staff to monitor farmer training and meeting attendance and this was used continuously from January 2017.

Training in CommCare provided to the project staff was comprehensive and began with a 2-day introduction in Myanmar. This was followed by two 5-day sessions at IRRI headquarters in the Philippines. These training sessions involved eight female scientists from various disciplines. The team heavily utilised the remote support made available via Skype and email.

During these MAD activities in the MyRice project, several other IRRI projects also began MAD activities utilising CommCare.

Planning

MAD planning for the farmer data sheet was integrated into a strategic planning meeting for the MyRice project's extension year. Leadership, researchers and field supervisors were all present at the meeting. The paper design for this data sheet was expanded on and altered based on input from these attendees. At the time, the sheet was converted

into a simple digital architecture with assistance from the AgImpact instructor. There were relatively few changes to this design or the timeline after that planning meeting.

While the paper design for the household survey was well established and field tested, it was complex enough to require support at the second training for reproducing the structure in CommCare. Some refinements to the questionnaire were made later with input from Myanmar field staff.

Training & Building

The MyRice project received three training workshops totalling 12.5 days (the most of all MAD series projects). The team also received additional remote support from AgImpact during the building phase. The farmer data sheet application was developed by researchers Arelene Malabayabas and Su Su San. A mixture of desktop and interview style testing was shared between researchers and the field team. Building of the very large and complex household survey application was shared between 4 of the 8 IRRI CommCare trainees, who formed a CommCare community of practice ("A Ladies"). The 15 survey forms were divided between the participants and the women met every two weeks over a 5-month period to engage in application building and to test and provide feedback on each other's work. Each of these researchers were assigned work on several projects and were only able to dedicate a small amount of time to CommCare development, so this solution worked very well for them. Though they all struggled with the steep learning curve initially, persistence, additional training and these fortnightly meetings helped them to gain confidence and improve their skills.

Calculations and smallholder feedback (in the form of farm inputs and production summaries) were added to the household survey application during the final training. Each subject within the extended household survey was isolated into its own form in the application. This allowed for a potentially fragmented interview process in case surveys were interrupted by the participating farmer's urgent tasks. Isolation of survey segments into individual forms also reduced the risk of data loss. A checklist was built into the app so that enumerators could review which forms had been completed and warning messages were built in to prevent duplication of forms.

During the enumerator training, a new version of CommCare Mobile with behavioural changes caused errors in the farmer data sheet. Researchers were able to overcome this issue by using an older version until the issue could be resolved. Two days of classroom training and two days of supervised field testing were organised for the Department of Agriculture (DoA) Myanmar staff who acted as enumerators. Eight DoA staff participated in the farmer data sheet interviews and fifteen participated in the household survey. During the enumerator training, researchers refined the apps based on daily enumerator feedback in the evenings.

Testing & Deployment

Several rounds of testing were required during the application building because the questionnaire was ‘logic heavy’, with different responses resulting in quite different behaviour in the forms. Because of this, numerous bugs were introduced into the MAD application when making late changes or fixing other issues. As a result, a lot of support was required close to the deployment date to get the application error-proof before the deadline.

Formal testing of the household survey application was conducted by Department of Agriculture staff over two days.

Monitoring and Evaluation

IRRI scientists accompanied the enumerators to the field during the large household survey. Data was downloaded each afternoon and light analysis and quality checks were

performed. A formal debriefing was held with enumerators each evening. The researchers travelled with a mobile hotspot to ensure an internet connection was available for these checks. Where data issues could not be reconciled on the spot, enumerators were sent back to check with the respondents before the team moved to the next village. When assistant scientist Su Su San had questions about the data format, specialists at IRRI in the Philippines were able to download a data set from the server and assist her with some rapid analysis.

Some of the data updates during this process were made on the server using CommCare's form editing feature. However, as some forms in the application were more complex, they were not compatible with the editing feature. In those cases alterations were made in an exported copy of the data.

User experiences

Research Staff

Twenty-six feedback responses were recorded from the MyRice research team during MAD adoption in the SRA. These indicated that the team found planning to be 'Easy' to 'Normal'. While the majority of responses marked Training and Building 'Easy' or 'Normal', almost one third of relevant responses recorded these phases as being 'Difficult' (Figure 8). Testing and Deployment phases were mostly recorded as being 'Easy' by staff and the two responses reporting for Data Monitoring & Management marked it as 'Normal'.

Most staff receiving support from AgImpact found it to be 'Very useful', while Dimagi support, the CommCare user Support Page and the User Group were mostly rated as 'Useful' (Figure 9). Two staff received support from other ACIAR projects with one finding it not 'Useful' and the other 'Very useful'.

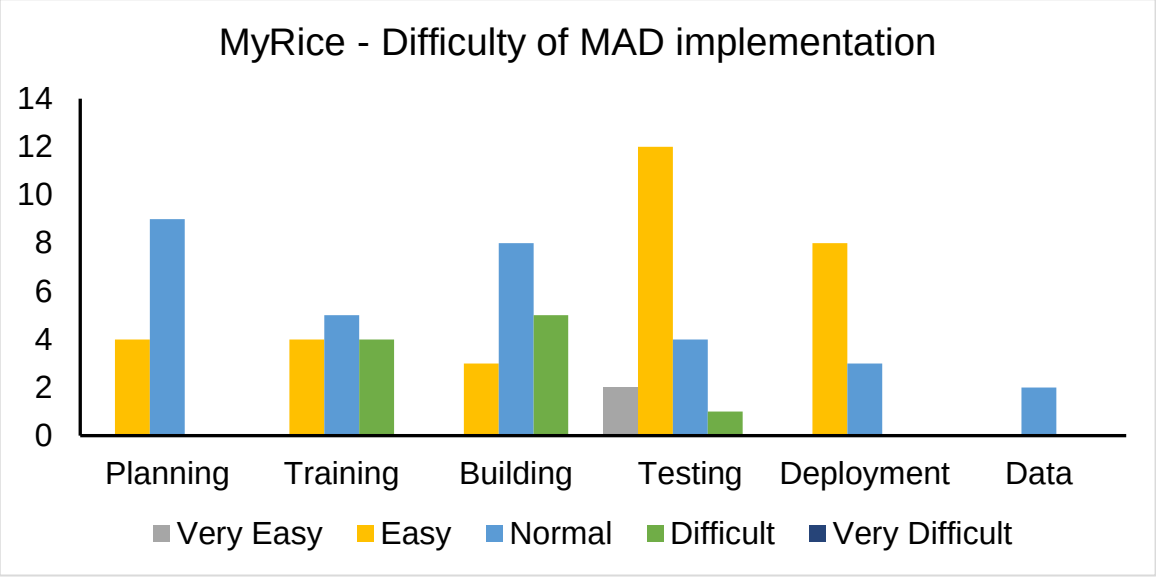

Figure 8: Ratings on the difficulty of various phases of MAD implementation from MyRice project staff. Total number of responses = 26. Responses recorded as 'Not Applicable' are not shown.

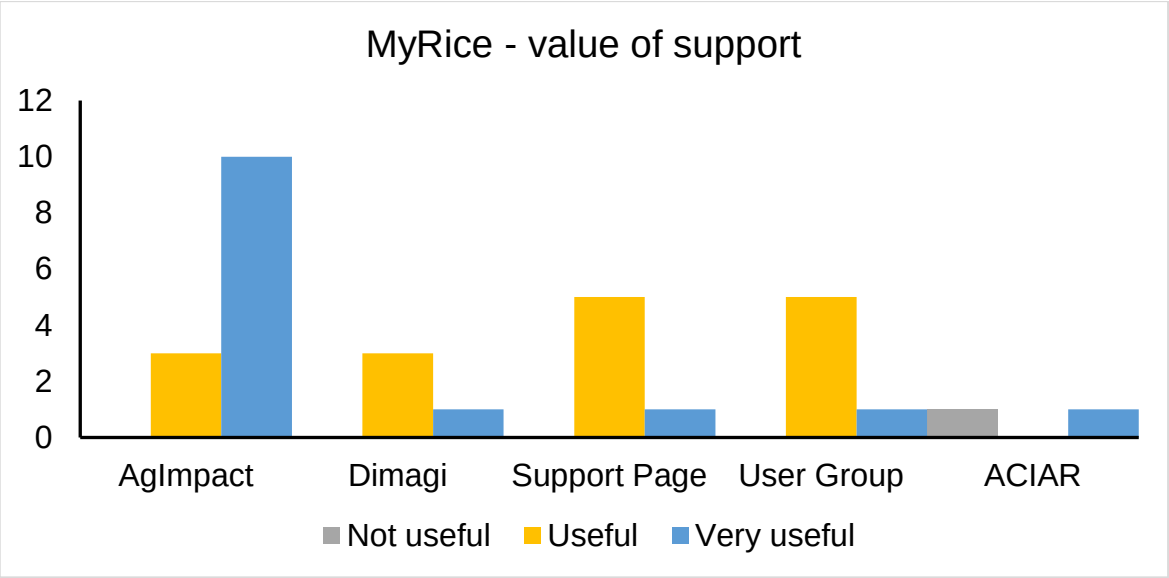

Figure 9: Feedback from MyRice project staff responses on the value of various support provided during the MAD 2 SRA. Responses recorded as 'Not Applicable' are not shown.

Enumerators

MyRice project enumerators provided responses to fewer questions than those in other MAD 2 SRA projects. Sixty-three percent of enumerators felt MAD apps would change the interviewer-farmer relationship before fieldwork took place, and this increased to 75% afterwards (Table 15). However, while 88% believed MAD apps would change their relationship with supervisors, this droped to 25% after fieldwork, suggesting that most did not find the mobile apps as revolutionary as expected. Nonetheless, half the enumerators believed apps would improve data collection before MAD deployment and this increased to 88% after they had experience with the apps (Table 15).

Table 15: MyRice enumerators' perceptions of the role of MAD apps in data collection. Results shown include baseline and endline comparisons.

Survey question	Baseline result	Endline result	Change
Survey responses (n)	8	8	0
Believe apps change interviewer-farmer relationship (%)	63	75	+12
Believe apps change supervisor-interviewer relationship (%)	88	25	- 63
Believe apps collect data more accurately (%)	50	88	+38

What were the benefits?

MAD implementation was well received by IRRI, leading to an improved capacity for MAD being developed at the organisation.

Capacity building

The researchers at IRRI were impressed with CommCare features compared to other MAD platforms they had used. As a result of the MAD implementation in MyRice, some IRRI staff now have the skills to develop any application they require. By building new

applications based on the structure of existing ones, IRRI staff were subsequently able to have sophisticated surveys for other projects field-ready in a much shorter time frame. Through this MAD implementation in MyRice, IRRI was beginning to establish a consistent data format across multiple projects – an aim outlined by Dr Singleton at the commencement of the MAD activities.

In all, nine applications were built by members of the "A Ladies" community of practice at IRRI. Five of those were variations on original applications built by the A-Ladies during the MAD 2 SRA. These applications have been deployed in three countries for three different projects. The team has a ‘pro’ subscription for their next CommCare endeavour - an application to support ACIAR's Rice-Fish project in collaboration with World Fish.

Reduced survey time

The researchers estimated that using the MAD household survey saved 1.25 hours per interview when compared to the paper-based questionnaire. This amounted to half the time taken to complete the paper survey and represented a total time saving of 39 working days. Data collection was completed much earlier than expected. The enumerators and farmers who had participated in the baseline were very grateful for the shorter interview times and researchers noted less fatigue than usual in the field. Department of Agriculture staff were pleased to carry tablets instead of boxes of paper and generally found the app made their job easier. This was especially so where skip logic was automated in the forms. The field staff stated that they wished the tablets had been used throughout the project.

Rapid feedback

Farmers appreciated the instant feedback regarding their seasonal profits and the agricultural scientists found the calculations greatly reduced the workload of analysis. A newer version of the household survey was subsequently created that included additional calculations that were missed the first time.

What were the challenges?

Challenges to MAD implementation in MyRice included the time taken for capacity building, testing advanced features, issues in design and form editing, adding qualitative observations and wider MAD implementation at IRRI.

Time spent building MAD capacity

Significant work was involved in up-skilling IRRI staff in CommCare application building. Over time, however, the team's support requirements reduced and at least two scientists at IRRI could now be considered experts in CommCare application building. A total of 56 combined days were spent by the two researchers most involved in the development of the farmer data sheet and household survey. Despite the challenges they continued to build capacity over the 9-month period of MAD implementation.

Testing advanced features

By pushing boundaries and using the most sophisticated coding available, the team frequently hit the limits of CommCare functionality and identified bugs that needed to be resolved by Dimagi staff. They twice underestimated the degree of testing and error handling required for such logically complex applications and had stressful periods of hard work prior to launch.

Form design issues

The researchers had an unwelcome surprise in the field when they realised the initial method for identifying the season was unsuitable. Originally, the season was recorded only once across multiple forms, despite the fact that data was being collected for multiple

seasons in a single application. This made the data more difficult to interpret and was overcome using Excel manipulation. Later, changes were made to the application to overcome this problem. Additional time spent analysing test data prior to deployment may have identified this issue before it become urgent.

Data editing

The research team found CommCare's 'data editing' features did not support their workflow. While this could be resolved by changes to the application architecture, the fact that the limitation was not documented meant they discovered the issue too late.

Use of paper to record inline comments

CommCare did not support inline comments on question responses. Enumerators were therefore encouraged to write down unexpected additional information on paper. Comment sections were included at the end of each form to record these qualitative observations.

Wider MAD implementation

While the "A-ladies" intend to hold institutional workshops to introduce their peers to CommCare, there is a challenge in transferring their skills to other IRRI staff. All of these women wish to pursue their original careers (they have full-time workloads as scientists) as much as possible rather than build applications for other projects or become trainers.

Financial and time costs involved

Financial costs

The financial costs involved for MAD implementation was not made available to AgImpact by the MyRice research team.

Time costs

The total number of AgImpact support days provided to the project was 34 (Table 16). An additional 5.2 days logged for travel and logistics. This was the highest number of support days for a MAD project and reflects additional training, the complexity of the apps that were created and the longer time required for capacity building. Project staff spent a total of 56 days adopting MAD applications. Most of this time was spent in training (15 days) building (18 days) and testing (11 days).

Table 16: Time spent (days) by AgImpact staff (support) and MyRice project staff (implementation) in each phase of MAD implementation.

Support type	Activity	AgImpact staff (days)	MyRice staff (days)	Combined
Face to face	Planning	6	6	11
	Training	15	15	30
Remote support	Building	4	18	22
	Testing	5	11	15
	Deployment	3	4	7
	Data management / monitoring	1	2	3
Total		34	56	90
	Travel costs	5.2		

Conclusion and key lessons

Implementation of MAD into MyRice using CommCare directly aligned with IRRI's existing ICT strategy, and can be considered as a success. Despite the steep learning curve that required a year of close support, the “A-ladies” team are now self-sufficient in building MAD applications in CommCare. The final project report data came from the two endline surveys that were built in CommCare. Data collection was completed just weeks before the report was released. Some key lessons from MAD implementation in this project include:

- **Training with an institutional** rather than a project focus has greater potential to be sustainable, and the challenges of learning the new technology can be managed by creating working groups with regular commitments to practice.
- Getting creative with **calculations built into apps** benefits both farmers and researchers.
- With **careful design**, the time-to-deploy for each iteration of a MAD application can be reduced.
- The best architecture for long questionnaires is not a single form, but **many shorter forms with integrated checklists** to guide enumerators
- Applications requiring complex or advanced design should be completed with **ample time for testing**.

7.2 MAD 4 TADEP

The MAD 4 TADEP SRA came about somewhat serendipitously. During the first MAD Masterclass in June 2016, all TADEP projects happened to have representatives in Canberra. Seeing this, ACIAR decided it would be valuable to explore the idea of projects 'quickly' adopting MAD apps. The goal was to find out if there were benefits to a research program with a diverse group of projects adopting a single MAD platform. The project specifically explored the advantages and disadvantages of a common MAD platform for the program (TADEP), for individual projects (e.g. Sweet Potato, Family Teams, etc), and for in-country partner institutions (NARI).

The following case studies outline the advantages and disadvantages of CommCare use (as a common platform) for the individual TADEP projects. Projects themselves had mixed experiences with CommCare. Those seeing the greatest benefits were able to take advantage of institutional MAD capacity fostered in the partner organisation NARI by MAD 4 TADEP. This highlights a key benefit from adopting a common app within a program. MAD capacity is easier to foster in a common partner organisation (compared with multiple partner organisations). This capacity can then be used to help individual projects if there is a common platform between projects and partners. Examples from the case studies in this section demonstrate that this may indeed have been the biggest benefit from the MAD 4 TADEP SRA.

The benefits and disadvantages to TADEP as a program are discussed in Section 7.3.6. The ability to build capacity within the partner institution NARI is also outlined and discussed in section 7.3.4 and 7.3.5.

7.2.1 PNG Sweet Potato

Key Points

Project Title: Supporting commercial sweetpotato production and marketing in the PNG highlands

Project code: HORT/2014/097

Location: Highlands of Papua New Guinea

Systems studied: Commercial Sweet Potato production

Research Activities: Simple survey for capturing information on various actors in the PNG highland sweetpotato value chain.

Lead Institution: Central Queensland University (CQU)

Partner institutions:

National Agricultural Research Institute (NARI)

Fresh Produce Development Agency (FPDA)

Disciplinary focus: Socioeconomic

Project stage for MAD Adoption of digital data capture commenced after proposal development and prior to survey design and implementation

Level of research staff experience with MAD: None

MAD activities: Mobile Acquired Data (MAD) training provided to project team, application designed and built for value chain survey.

CommCare package used: Standard

MAD feedback mechanism: None

Key lessons:

1. **Selecting appropriate app managers** and taking time at the start to train team members appropriately is key to successful MAD implementation.
2. **Engaging and training all levels of management** helps to ensure staff trained to operate the technology are suitably resourced and supported by the organisation to carry out the MAD activities.
3. There was a high level of **acceptability among local farmers** on the use of digital devices to capture information.

Project Background

Within the broader development goal of improving the livelihoods of sweet potato producers and their communities in the highlands of PNG, the specific aim of this project was to sustainably increase the contribution that sweet potato makes to cash income and food security. The project aimed to achieve this by promoting the adoption of a series of transformative improvements in selected sweet potato value chains.

Specific Objectives

1. To develop and strengthen market-oriented sweetpotato supply chains
2. To build capacity of sweetpotato value chain players
3. To develop a 'clean seed' scheme to increase availability of clean planting material of sweetpotato.

More information about the overall project can be found on the ACIAR website http://aciar.gov.au/project/hort/2014/097

Perceptions and previous experience of MAD technologies

Existing capacity of the team to use and develop mobile applications was minimal. Training was requested for both Australian researchers and in-country partners. Beyond MAD training, the team required a moderate level of technical support during application building.

The project identified 3 main areas where they wanted to adopt the use of CommCare:

1. In collecting and disseminating market knowledge to farmers on a weekly basis,
2. For surveying farmers about the comparative performance of new planting materials over time (5 years), and
3. For a small qualitative survey to capture farmer perceptions around new technologies and approaches.

Tailored Support Package for Project

MAD Activities

Digital data capture was introduced to the project after the proposal development phase. CommCare was adopted by the project for a simple value chain survey capturing information on various actors in the sweetpotato value chain. Training and app development occurred prior to survey design and implementation. A period of 2-3 months was scheduled between application design and deployment. As the surveys had not previous been developed for 'paper', the project was able to design a more flexible tool within CommCare.

Application building and data collection was conducted by trained team members from the local partner organisation: The Fresh Produce Development Agency (FPDA). Despite a few logistical, infrastructure and capacity issues, the team were able to deploy and capture data using the tablets and present preliminary data to stakeholders within a week of data capture.

Needs assessment and planning

A scoping discussion was held between the project and SRA team to determine the priority support needs of the project team. The team had limited previous experience with using MAD applications, but staff were confident in their ability to learn to the new technology and implement it into their workflows. The team was interested in understanding how they could use the application to improve information flow and feedback to key players in the value chain. The project team saw using CommCare as an opportunity to improve consistency of the data they were capturing and enable real-time

data checks. Support was requested for training in app building. The team had not yet developed surveys so much of the planning for CommCare occurred during the training.

The sweetpotato project worked closely with the (FPDA) during the early planning and development stages of its value chain mapping survey. The project sought to draw on FPDA's expertise and familiarity with key value chain actors, while also utilising FPDA's extension officer network for the management and coordination of data collection. This reliance on an in-country team (and therefore the organisational support of FPDA to meet project outcomes) meant coordinated design and planning was needed. This provided an opportunity to observe local development partnerships that create long term ownership and the potential for broad based uptake of digital technologies.

Training / Building

The Sweet Potato project team started with minimal experience and exposure to smartphones or smartphone apps. Their first introduction to CommCare was during the 4-day beginner app building workshop delivered by AgImpact. The training was attended by the project lead Professor Phil Brown along with two management personnel and two junior staff members from FPDA.

With only a skeleton survey developed prior to the training, the first day focused on developing the research survey architecture – i.e. workflows and application structure based on project aims and objectives. Staff discussed what questions needed to be asked to address the project aims, and tried to understand how the data would look for analysis purposes. Decisions were made around how to label questions, how many forms are required and application structure. Senior project staff, found it valuable that their junior team members were getting the opportunity to be stepped through the whole research process, something they were not typically involved in.

Other features such as coding variables, validation conditions and skip logic were more difficult for the trainees to learn. The team were able to build the value chain survey application for CommCare during the facilitated training provided by AgImpact.

The training sessions also sparked discussions around the broader utility of the platform within FPDA as an organisation. These included ideas to use CommCare to digitise FPDA's market data collection and to manage their flagship MOMIS (mobile market information system) database. Other significant opportunities identified included using CommCare to introduce end-to-end digital work processes into their routine Village Extension Worker (VEW) reporting system. The team's current paper-based systems meant that data was often lost in the field or in emails. Trainees felt CommCare was an opportunity to consolidate information in a more systematic way within their organisation.

Testing and deployment

The team had a finished workable app on the third day of the facilitated training workshop. On returning to the FPDA offices, however, they found that the version of the browser on their desktop computers was not compatible with CommCare HQ, nor was it suited for making edits to the application. This meant that they could not update or download the latest version of the application. Of the group of five project staff that underwent training, three were based at the FPDA headquarters in Goroka and one at the Mt Hagen office deep in the Highlands. At the latter location, frequent struggles with infrastructure, poor internet connectivity and limited organisational support for IT troubleshooting persisted.

Due to problems with internet connectivity, the team had to field test the survey in the Goroka and Daulo districts using a paper print out of the app export. During the field test, some application questions needed to be adjusted to suit the local context. Using the only Digicel WiFi data dongle provided as part of the project, the team attempted to make these edits on the tablet touch screen. However, these edits were not possible due to

internet speed, display size and other constraints. Additionally, updating the app proved to be one of their biggest challenges.

The project had not established clear lines of reporting from the field if there were issues with the app. This meant team members did not feel empowered to email the project leader or contact AgImpact for support with the app. Only when the project leader visited the field was support requested by the project. Support during this time included minor application edits and uploading look-up tables.

On a more positive note, farmers approached were excited by the novelty of the tablet and the communities were very interested in receiving extension information from the FPDA and about the fact that they had visited. In the major commercial sweetpotato hub of Asaro, a farmer commented that a previous survey conducted on paper had not provided the feedback that was promised to them. The fact that the sweetpotato project team used tablets meant to him that this time they were serious, and that the data was being registered somewhere. The FPDA staff also used the photo capture feature to update farmer records and add contact details of growers who produced on a large scale.

Monitoring and Evaluation

Despite initial setbacks the team successfully deployed the value chain survey and captured data on the tablets. The findings of these surveys were then presented to stakeholders within a single week of capturing the information. This rapid feedback was in stark contrast to other data collection activities within the partner FPDA organisation.

FPDA's weekly data collection for its VEW program was completed through a tiered network of paid and unpaid extension officers and influential farmers. These individuals collected data and filed them using an inefficient carbon copy system. An extension officer was then required to collect those forms from the remote sites on a weekly basis. This presents an example of further opportunities for MAD to free up staff time and therefore improve extension service delivery to farmers. One manager of this Village Extension Worker (VEW) program summarised the potential by stating 'If we didn't have to spend so much time on collecting forms, the extension officers could actually work on thinking about what training needs farmers have'.

User experiences

Research staff

Unfortunately, only three CommCare users responded through the feedback forms provided by the SRA team. From these responses, users indicated that most tasks in the MAD implementation ranged from 'Very Easy' to 'Normal' in their difficulty (Figure 10). The sole staff member involved in application deployment rated it as 'Difficult'. AgImpact support was rated as being 'Very useful', while direct Dimagi support and the CommCare support page were both rated as 'Useful' (Figure 11).

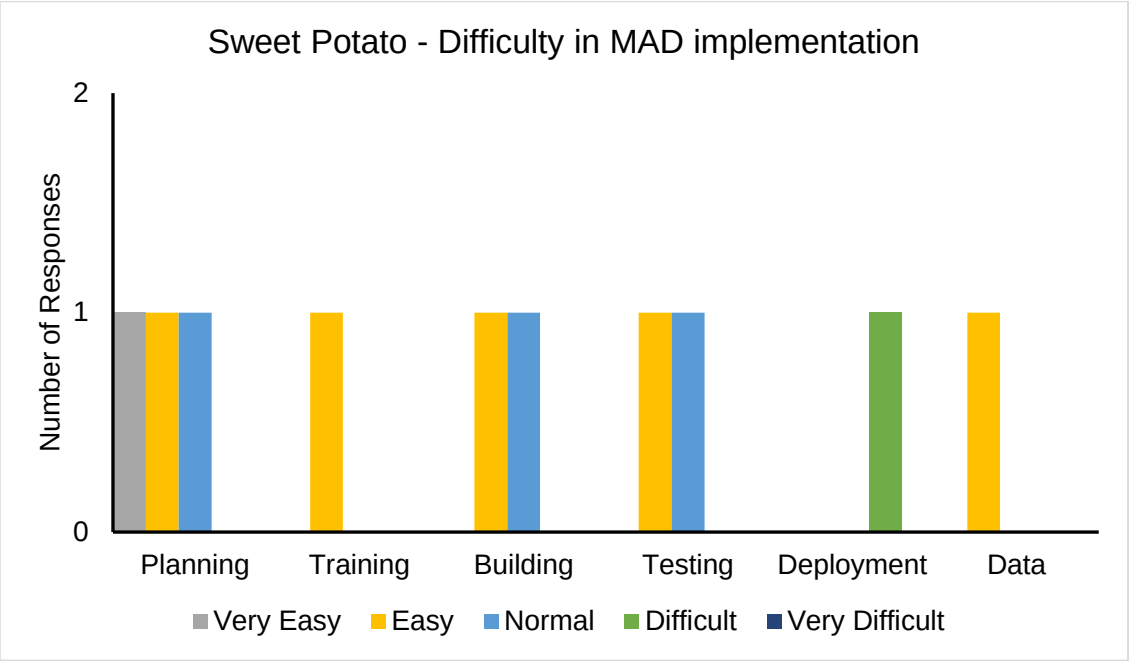

Figure 10: Ratings on the difficulty of various phases of MAD implementation from Sweet Potato project staff. Total number of responses = 3. Responses recorded as 'Not Applicable' are not shown.

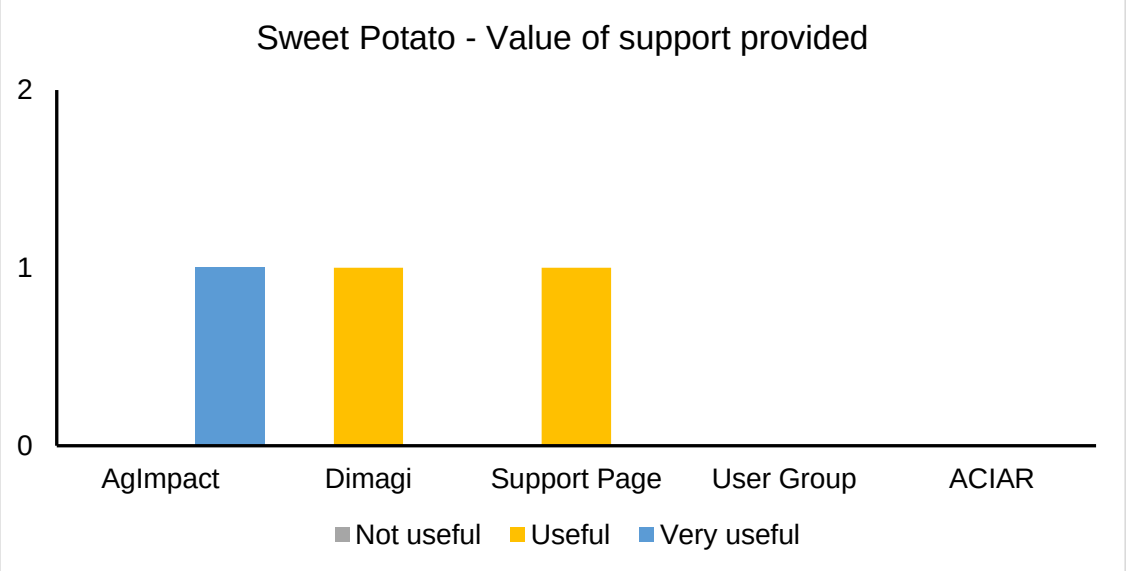

Figure 11: Feedback from Sweet Potato project staff responses on the value of various support provided during the MAD 2 SRA. Responses recorded as 'Not Applicable' are not shown.

Financial and time costs involved

Financial Costs

The total operating costs reported by the Sweet potato project was $2,110. Specific items for this spending were not reported.

Time costs

The time spent by AgImpact providing support to the Sweet Potato project was 5 days (Table 17). This consisted of one day in planning with project staff and all remaining time spent in the single training event over four days. Sweet Potato project staff spent a total of

two days in planning and thirteen days in training. The additional training days reflect the fact that four staff were in attendance during these sessions. As the application building took place within the training session provided by AgImpact, only one day of 'building' was logged for time spent in the field testing and editing the application (Table 17).

Table 17: Time spent (days) by AgImpact staff (support) and Sweet Potato project staff (implementation) in each phase of MAD implementation.

Support type	Activity	AgImpact staff (days)	Sweet Potato staff (days)	Combined
Face to face	Planning	1	2	3
	Training	4	13	17
Remote support	Building	0	1	1
	Testing	0	0	0
	Deployment	0	0	0
	Data management / monitoring	0	0	0
Total		5	16	21
	Travel time	2.2		

Sustainability of MAD capacity in-country

The adoption trajectory of this project highlights the influence of institutional arrangements and contextual factors such as established organisational routines, working relations and the physicality and familiarity of paper in shaping the outcomes of the digitalisation of projects. Critical lessons can be learnt on the need to plan not just for technical upskilling to handle apps; but on thinking holistically about institutional culture and organisational barriers to successful deployment.

Despite connectivity issues and environmental constraints faced at the onset, another group at FPDA took the lead for digitising organisational monitoring and evaluation processes. Since the FPDA were already considering ways to increase digital activities internally, the exposure to CommCare came at an opportune moment. It was a great demonstration of an 'actual' technology rather than a 'concept' that they could use to better visualise how they can embed more digital approaches into their business.

The team organised an app workshop to digitise their extension work and MOMIS (mobile market info system) data collection and continued to be keenly interested in the wider adoption of the technology.

Challenges building sustainable MAD capacity

Sustainability of in-country MAD capacity was hindered by low digital literacy levels and selected trainees having low numeracy skills (relative to those needed for CommCare coding). Other challenges are poor connectivity,

Within PNG, most internet users have only had access to the platform for a few years (World Development Indicators, The World Bank 2017). With this context in mind, the team picked up the basic application building rather quickly. However, there was some

confusion about how information was sent to the server and stored. Conceptualising data storage on a server overseas and the intangibility of network architecture was a key digital literacy issue that appeared to hinder trust. This issue came across clearly during the training period.

Other CommCare features such as coding variables, validations and skip logic proved challenging for some of the team members less familiar with digital formats. Writing basic skip logic, validation conditions and calculating expressions requires a modicum of numerical and statistical literacy and should be a consideration when selecting app managers for a project.

Other lessons in institutional capacity building from this project included:

1. Simple programming logic used by CommCare presented an initial steep learning curve to users unfamiliar with digital formats, highlighting the importance of selecting appropriate app managers and taking time at the start to train team members appropriately.
2. Engaging and training all levels of management helps to ensure staff trained to operate the technology are suitably resourced and supported by the organisation to carry out the MAD activities.

7.2.2 PNG Cocoa

Key Points

Project Title: Enterprise-driven transformation of family cocoa production in East Sepik, Madang, New Ireland and Chimbu Provinces of Papua New Guinea

Project code: HORT/2014/096

Location: East Sepik, Madang, New Ireland and Chimbu Provinces of Papua New Guinea

Systems studied: Smallholder Cocoa Production

Research Activities: 1500 household baseline and monitoring surveys

Lead Institution: La Trobe University

Partner institutions:

National Agricultural Research Institute (NARI)

PNG Cocoa and Coconut Institute Ltd. (CCIL)

Disciplinary focus: Biophysical (Cocoa management)

Project stage for MAD implementation CommCare was introduced into this project after field work had already commenced. Paper surveys had been implemented in one province already.

Level of research staff experience with MAD: None

MAD activities: Transferral of paper-based survey to CommCare, app building training

CommCare package used: Standard

MAD feedback mechanism: None

Key lessons:

- Not resourcing an app manager for the project, led to inadequate training and support for field staff during implementation.
- Important to plan for 'going digital' and factor in Digital Data Collection Apps from the start. Retrofitting a project after budget allocations have been made and research activities have commenced generates a unique set of challenges.
- Without a well-defined scope and a needs assessment at the onset, many other important project activities were sidelined because of the attention demanded by CommCare.
- Devices used for data capture should be tested adequately in the field before purchasing a large number of devices or commencing data collection.

Project Background

This 5-year project aimed to make smallholder cocoa enterprises in Papua New Guinea's East Sepik, Madang, New Ireland and Chimbu Provinces more productive and profitable, by working through village extension workers.

Project objectives:

1. Foster the development of profitable, self-supporting, village-based cocoa extension and other services as micro-enterprises supported by financial institutions, commercial cocoa buying and supply companies, and existing research and extension services
2. Introduce and evaluate on farms, with farmer participation led by village extension workers, transformative new cocoa cultivars and cocoa selection, propagation, production and postharvest methods Conduct surveys, extension, development and field testing of new methods of cocoa fermentation and drying to improve cocoa quality
3. Introduce and evaluate on farms, with farmer participation led by village extension workers, options for development of new cocoa farming systems integrating food crops, livestock and high-value shade and other tree crops.

More information about the overall project can be found on the ACIAR website http://aciar.gov.au/project/hort/2014/096

Perceptions and previous experience of MAD technologies

The team had no prior experience with mobile data capture applications. Their intention was to use CommCare for both baseline and monitoring surveys. A large driver for the team to adopt this technology was to cut out the need for manual data entry at the back-end after data collection.

The team showed interest in exploring the possibilities of using CommCare for training their extension agents. The project had 66 enumerators capturing data in the field, making it the largest scale CommCare deployment within the TADEP programme. A medium level of support was requested for training and implementation.

Tailored Support Package for Project

CommCare was used on smartphones to conduct baseline and monitoring surveys in 1500 households across the New Ireland, Madang, Chimbu and East Sepik provinces of Papua New Guinea.

Mobile acquired data capture was adopted into this project after paper based data collection for the baseline had already commenced in some provinces, but the team planned to substitute CommCare as soon as possible for the other regions. The project team had no previous experience with using mobile data capture applications and requested a medium level of support in app building and deployment.

A cascade training approach was taken, whereby the lead researcher who received comprehensive app building training, trained an in-country staff member who then went on to each train 66 field staff. The project had very limited time between app development and deployment which led to a number of constraints in the field and ultimately caused the team to revert to their paper surveys.

Needs assessment and planning

This project worked in remote areas of New Ireland, Madang, Chimbu and East Sepik provinces. As CommCare was introduced into this project after field work had already commenced, the timeframe for development and implementation was extremely short.

Owing to budget constraints, they aimed to use locally available Alcatel/Huawei smart phones instead of tablets for data collection. Poor transport infrastructure combined with the remoteness of the communities being surveyed presented significant challenges to this project.

The project therefore did not undertake a full needs assessment at the onset and proceeded without a well-defined scope. As a result, many other important project activities were sidelined and delayed because of the attention demanded by CommCare.

Training & Building

The project leader received intensive training from AgImpact that helped him to convert the baseline survey already in use at some field sites into a digital format. Challenges arose when the knowledge and skills acquired during this training were then transferred to the project managers in PNG, who then had to train Provincial government officials working as enumerators for the project.

Due to time constraints, data collection using CommCare started before field staff had been adequately trained to be confident and competent in its use. This 'light touch' training approach proved inadequate when there were initial glitches in downloading the app and issues like the Huawei handset not performing as expected.

Inadequate lead-time and not having a team member dedicated to the role of app manager meant that the field staff did not receive adequate support or training in preparation for implementation.

Testing & deployment

Piloting the application in the field enabled the team to see that their original survey design did not quite align with their existing field workflow. This was overcome through subsequent changes made to the applications. However, further challenges arose when the less expensive smartphones being used for data collection could not hold their charge for a full day. This made data collection difficult in the scattered locations in Madang and East Sepik where enumerators had to camp without electricity.

The enumerator team included people with different backgrounds and training with some field staff having little experience in mobile phone use prior to the CommCare training. Several enumerators were handling a smartphone for the first time and there was no technical skill base to draw from (especially as issues arose in the field). Of the 20 handsets purchased for the project, 3 were stolen and one (with unsaved data) was lost when crossing a river during fieldwork. The isolation of field sites meant that the bulk of staff time was spent in travelling to make contact with farmers in locations rather than in actual conducting application testing with farmers.

The team felt as though the only time saving from CommCare was that of data entry into excel. Given these significant infrastructure barriers and geographic frictions, losing data would be disastrous and enumerators requested paper copies of the shorter survey as a back-up. Each team collected data on paper and on the app as much as possible. However, it was later discovered that only some cases had properly saved on CommCare due to the team's unfamiliarity with the how to use the application. There were instances where enumerators entered the data from their paper forms into the CommCare App when back at their offices after field visits.

Monitoring & Evaluation

With a large sample size, the project also faced problems with data management as they expected a shareable output in a format that is user friendly and amenable to export based on the province it was collected from. Due to unfamiliarity with the tool and the capacity to manage the data downloads effectively, the data collected on the paper forms

was manually entered into excel and shared among stakeholders. The fact that they had so many problems posed a serious 'credibility issue' as the team had to explain to provincial government officials why a system that initially looked so promising did not work out the way they expected.

User experiences

Only one member of the PNG Cocoa project team provided feedback on the difficulty of MAD implantation or the value of the support provided during the SRA. Planning and Training were rated as ‘Normal’, but Building and Testing recorded as being ‘Very Difficult’ but the respondent (Figure 12), reflecting the significant issues faced in the field. AgImpact support was nominated as ‘Very useful’ while the CommCare Support Page and support from other ACIAR projects was rated as ‘Useful’ (Figure 13).

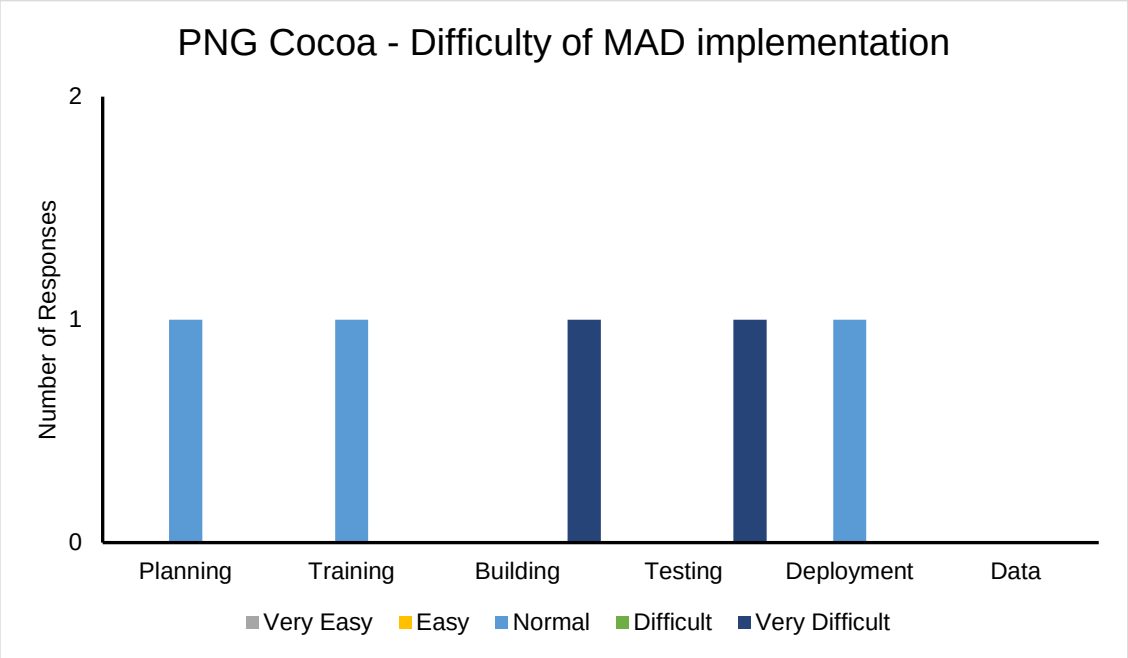

Figure 12: Ratings on the difficulty of various phases of MAD implementation from PNG Cocoa project staff. Total number of responses = 1. Responses recorded as ‘Not Applicable’ are not shown.

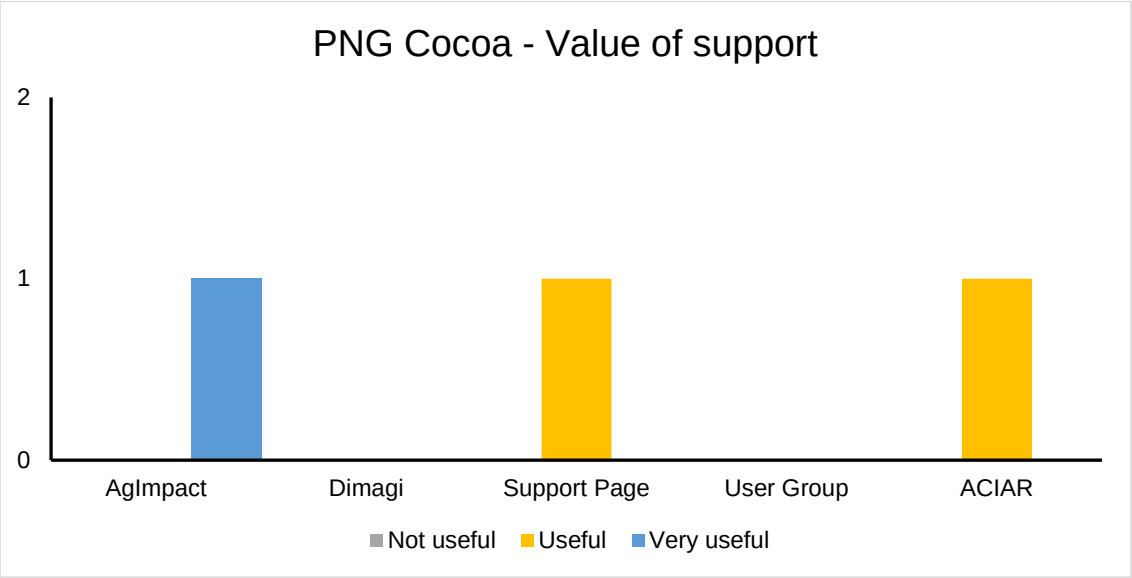

Figure 13: Feedback from PNG Cocoa project staff responses on the value of various support provided during the MAD 2 SRA. Responses recorded as 'Not Applicable' are not shown.

Financial and time costs involved

Financial Costs

The project reported total operation costs involved in MAD implementation as only $66. This is almost certainly not reflective of the actual operational costs incurred during the SRA period. Instead more likely mirroring the low response rate also seen in the user feedback.

Time costs

The reported support time from AgImpact for the PNG Cocoa project totalled 10 days (Table 18). Training of the project lead took the most support time of all activities (4 days), with planning, building and testing all being allocated equal remaining amounts (2 days). Project staff recorded only 3 days in training and building, 4 in testing and one in deployment (Table 18).

Table 18: Time spent (days) by AgImpact staff (support) and PNG Cocoa project staff (implementation) in each phase of MAD implementation.

Support type	Activity	AgImpact staff (days)	PNG Cocoa NARI staff (days)	Combined
Face to face	Planning	2	0	3
	Training	4	3	7
Remote support	Building	2	3	5
	Testing	2	4	6
	Deployment	0	1	1
	Data management / monitoring	0	0	0
Total		10	11	22
	Travel costs	0.6		

Sustainability of MAD capacity in-country

Unlike other MAD 4 TADEP projects, the PNG Cocoa team did not receive in-country support for implementation from AgImpact. As such, they felt that having a group of people trained in CommCare and MAD capture in-country would be a valuable resource for the future. This would be particularly useful for providing technical and troubleshooting support.

The project secured the participation of provincial government officers by assuring them that they could access the data on smallholder practices, which (due to capacity constraints around data management) did not eventuate. The combined effects of the challenges faced in the field led the team to revert back to using paper questionnaires to capture their data.

Conclusion and key lessons

There are several learnings from the uptake and implementation of digital data capture within this project, many of which can be addressed by allocating time at the start to conduct a robust needs assessment and integrating digital data capture into project plans from the beginning.

It is important to allow adequate time to plan for ‘going digital’ and factor in MAD apps from the start. Retrofitting a project after budget allocations have been made and research activities have commenced generates a unique set of challenges. The project was time poor and focused on completing baseline surveys so that they could begin planned training programs. As the core focus of the project was establishing Cocoa Model Farmer-Trainers (CMFTs) after the first year, surveys had to be rushed in order to ensure yield data by the end of the project’s five years.

Devices used for data capture should ideally be tested adequately in the field before purchasing a large number of devices or commencing data collection.

7.2.3 Bougainville Cocoa

Key Points

Project Title: Developing the cocoa value chain in Bougainville

Project code: HORT/2014/094

Location: Bougainville, Papua New Guinea

Systems studied: Smallholder cocoa production

Research Activities: 8000 livelihood household surveys (baseline and Endline);

Lead Institution: The University of Sydney

Partner institutions:

Australia: Mars Australia
Papua New Guinea: University of Natural Resources and Environment, Cocoa and Coconut Institute of Papua New Guinea, Autonomous Region of Bougainville Department of Primary Industries and Marine Resources.

Disciplinary focus: Biophysical (Cocoa tree management) and socioeconomic (demographics, health, market settings)

Project stage for MAD implementation: Beginning of project

Level of research staff experience with MAD: None

MAD activities: Transferral of paper-based survey to CommCare, real-time data monitoring

CommCare package used: Standard

MAD feedback mechanism: Data sharing with key project stakeholders and the Autonomous Bougainville Government Department of Health.

Key lessons:

- Formal assessment of project needs and resources at start of project provided good preparation for MAD implementation.
- Outsourcing application development enabled shorter implementation time, trade-off was lower in-team capacity development.
- When piloting, best to conduct with local team members in a setting that mimics the real fieldwork scenario to limit having to edit the application again once in the field with poor internet connectivity.
- Selecting appropriately skilled team leaders can help to support implementation and team members who might take a little longer to adjust to the new technology.
- Using MAD provided an opportunity to streamline and coordinate datasets with other in-country projects, as a means of reducing duplication and burden on the community and improving comparability of datasets.

Project Background

This project aimed to improve the profitability and vitality of smallholder cocoa farming families and communities in Papua New Guinea. Bougainville is an autonomous province in Papua New Guinea recovering from a decade-long crisis that significantly disrupted the society and economy. Before the crisis, cocoa was a major contributor to the economy; more than 80% of Bougainvilleans produced cocoa. The project aimed to foster and strengthen public and private sector partnerships and develop enterprises that enhance productivity and access to premium markets, while promoting gender equity, community health and well-being.

The research aims and questions in the study were:

1. To improve the productivity, profitability and sustainability of cocoa farming and related enterprises

   Key research question: *Among the many technologies available for intensification of cocoa production, which options and combinations are most appropriate to the social and biophysical context of Bougainville?*

2. To understand and raise awareness of the opportunities for improved nutrition and health to contribute to agricultural productivity and livelihoods

   Key research question: *To what extent is poor health and nutrition a barrier to improved agricultural labour capacity and living standards?*

3. To foster innovation and enterprise development at community level

   Key research question: *Can public sector R&D investment catalyse enterprise development leading to diversified and stable incomes and improved social outcomes for cocoa farming families?*

4. To strengthen value chains for cocoa and associated horticultural products

   Key research question: *How can market access and value chain efficiency for cocoa and other farm and garden outputs of Bougainville be enhanced to improve farm family livelihoods?*

More information about the overall project can be found on the ACIAR website (http://aciar.gov.au/project/hort/2014/094).

Research activities

There is limited up-to-date data on households and cocoa farms available in Bougainville. Therefore, the project used CommCare to conduct a large cross-sectional livelihood survey (Baseline & Endline) with approximately 10% of the population. Topics being studied included demographics, community health, livelihood strategies and cocoa farming. These surveys were being conducted across the Northern, Central and Southern regions of Bougainville, including some very remote communities. Data was being captured at the household and individual levels from men, women and mothers of children under 5. The size and level of detail of the questionnaire would have been incredibly time consuming and logistically challenging to implement on paper.

Perceptions and previous experience of MAD technologies

The project had only basic app experience (apps for disease diagnosis) but they had already begun a supported CommCare implementation for their baseline surveys with the help of a research assistant with a high level of previous CommCare experience. In

addition to baseline and endline surveys, the project team saw the potential for extensive CommCare use throughout the project. This was particularly in the areas of training, extension and remote diagnosis. With the support of their research assistant, the team felt confident in the abilities to develop and implement their MAD application.

Tailored support package for project

MAD Activities

Mobile acquired data (MAD) capture was included in the project proposal from the outset. With minimal prior experience in MAD among project staff, app building, training and deployment were outsourced to an external party. A draft application was piloted in the field in July 2016 with a revision and testing period of 2 months prior to deployment. Data was captured on tablets by 30 selected and trained community members from each of the 3 regions. Data was monitored in near real-time throughout fieldwork. Summary datasets were provided to key stakeholders after the first region was completed. In addition to baseline and endline surveys, the project was subsequently looking at the possibility of using CommCare in the future for training, extension and remote diagnosis.

Needs assessment and planning

The Bougainville Cocoa project is one of the few that had the opportunity to build digital data capture into their project design from the beginning. This helped ensure adequate time and resources were allocated for implementation of this new technology.

With limited previous experience using mobile data capture tools and time constraints to commence data collection, the team chose to outsource the application development, training and management. Taking this approach enabled the team to plan appropriately and focus on other aspects of this large scale, multi-disciplinary project. The project had a dedicated application manager who was on hand to assist with any digital data capture related issues the team faced.

Training & Building

The project team developed a paper version of the questionnaire using a combination of surveys that had been previously validated in similar settings. The paper questionnaire was then used as the basis to translate the questionnaire into a digital CommCare application by the external app builder. This was done through a consultative and iterative process between the outsourced application manager and the research team. The team did not receive any technical training on CommCare application building.

Testing & Deployment

Despite the generous time for revision, the team faced some issues with the application questions and translation of the questionnaire. A draft application was piloted in-country at a chocolate festival with a revision and testing period of 2 months prior to deployment. While the application was piloted in-country, this setting was different to that of the field survey which contributed to application issues not being addressed during piloting. Ultimately, the application had to be translated and edited in the field. With unreliable internet connectivity in Southern Bougainville this was incredibly challenging. As a result, the team were forced to delay the start of fieldwork to the following week and drive 4hrs to find better internet to make the necessary changes.

Data was captured on tablets by 30 selected and trained community members from each of the 3 regions. Enumerators were nominated by participating villages based on a set of criteria provided by the research team. Additional community members were selected to be village facilitators who were responsible for preparing villages for the enumerators arrival and explaining the purpose of the project. A key advantage of creating ownership through a team of facilitators generated from the villages themselves was that there was a

surprisingly low rate of refusals. Different enumerators adapted to tablet use and navigation at different rates but following training the majority were found to be technically capable.

Fieldwork operations were ably led by an enumerator who was recruited from the South as part of the initial call for a field team but then was voted team leader. He had a background in web development and in Electrical Engineering and guided the implementation of the app based data collection in South, North and Central districts.

This project worked in remote settings, with some Village Assemblies being accessible only by boat. The tablets generated a lot of interest among farmers who wanted to see photos of houses from other Village Assemblies they had never travelled to and those who just wanted their photos to be taken. During field work two of the tablets were damaged and had to be replaced. This demonstrated the importance of having spare devices (as was the case in this project) to ensure field activities were not delayed as a result.

Most enumerators were allowed to buy the tablet at the end of data collection for a subsidised rate as an incentive to look after it. Majority of these tablets had already been personalised with desktop photos and the degree of ownership amongst enumerators was high. This is in keeping with other global CommCare case studies that show how allowing some non-prescribed uses of the device may motivate enumerators to learn advanced tasks (Schwartz, Bhavsar, Cutrell, Donner, & Densmore, 2013).

Monitoring & Evaluation

Real time data management and data sharing was built into the core aims of the project. The potential for the system to generate participative conversations around the data was seen as the key point of departure for future extension work. The project also worked with some of the other TADEP projects to see where there were opportunities to streamline the type of data being collected and shared to reduce duplication and improve comparability.

The project leader intended to present information collected and ask the community what they would like to know based on the data. The six-year project now seeks to develop diagnostic apps about cocoa diseases and link data to soil information from another ACIAR project. This will provide advice through embedded images and audio. Furthermore, there is interest in going a step further with their next project (funded through a Gates foundation grant in Indonesia). They aim to start by asking communities what they would like to know and then develop an app based on these consultations.

The collaboration and data generated was of immense interest to ABG health departments and local partners. Using MAD enabled data to be shared with key stakeholders on an ongoing basis before data collection was complete. This helped to strengthen relationships with partners and provided a timely demonstration of the value of the project idea to multiple stakeholders.

User experiences

Portability of the tablet as well as its value as a cultural commodity was appreciated by the enumerators. During the course of fieldwork, field staff came across a team from the national statistical office who were using paper questionnaires that had to be transported in large petrol boxes if they were to be kept dry and safe while travelling across flooded rivers. There was a significant boost in field staff morale and motivation at being part of a project that was seen to be state-of-the-art and more advanced than the technology at the disposal of national government offices. Most enumerators were satisfied with the user interface and were able to depend entirely on the tablet for data collection.

Six responses from Bougainville Cocoa project staff were provided feedback on MAD implementation to the SRA. Their responses indicated that none of the staff found MAD implementation difficult, with the majority finding all phases either 'Very Easy' or 'Easy' (Figure 14). Five of the six respondents found AgImpact support to be 'Very useful' (Figure 15). All other support mechanisms were ranked as 'Useful'.

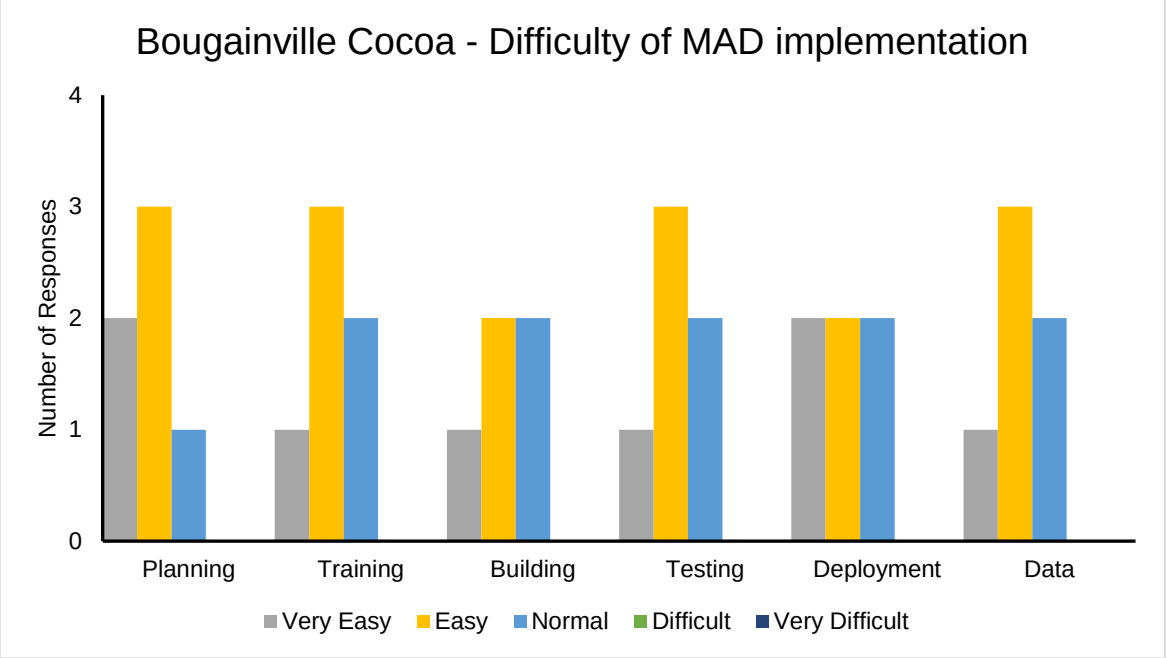

Figure 14: Ratings on the difficulty of various phases of MAD implementation from Bougainville Cocoa project staff. Total number of responses = 6. Responses recorded as 'Not Applicable' are not shown.

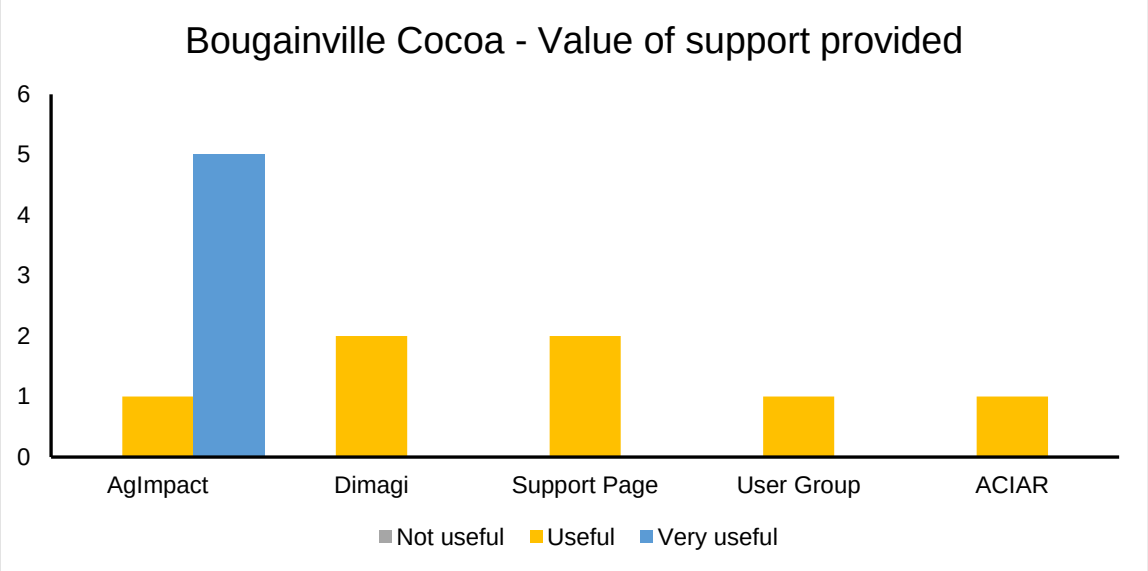

Figure 15: Feedback from Bougainville Cocoa project staff responses on the value of various support provided during the MAD 2 SRA. Responses recorded as 'Not Applicable' are not shown.

Financial and time costs involved

Financial costs to project

The Bougainville Cocoa project reported spending a total of $6,650 on operational expenses during MAD implementation. The cost of AgImpact support was covered by ACIAR separately to the project budget and is not included in this figure.

Time costs

The total number of support days provided to the NARI team working on Bougainville Cocoa was 23 (Table 19). Most of this time was spent providing remote assistance during deployment and reflects the challenges associated with translation and editing of the application in the field. This could have been reduced through pilot testing the application in a more appropriate site.

Table 19: Time spent (days) by AgImpact staff (support) and Bougainville Cocoa project staff (implementation) in each phase of MAD implementation.

Support type	Activity	AgImpact staff (days)	Bougainville Cocoa NARI staff (days)	Combined
Face to face	Planning	1	4	5
	Training	1	6	7
Remote support	Building	6	1	7
	Testing	1	5	6
	Deployment	14	14	28
	Data management / monitoring	0	4	4
Total		23	34	
	Travel costs			

Sustainability of MAD capacity

This project did not receive training in application building due to their decision to use an external app developer. However, enumerator training in the use of MAD apps for fieldwork took place. This upskilling of field staff was very successful and left local capacity for future MAD fieldwork. Thirty enumerators nominated by their local village were trained in the use of MAD technology. This means future research projects operating in these areas of Bougainville have locally-endorsed and embedded enumerators with experience in MAD to draw upon. There was a tangible appreciation among enumerators for the skills developed. In one instance, a young female enumerator reported how the skills gained while handling devices and through digital data collection was looked upon favourably when she applied for another project on completion of her work with the team. Continued use and fostering of this capacity will help ensure its sustainability.

Conclusion and key lessons

The key lessons from implementing MAD in this project were related to staff empowerment and logistics. The local staff were successfully encouraged to invest in the project through:

1. Upskilling in use of digital devices for data collection;
2. Allowing possible purchase of devices;
3. Seeing other government researchers using older, less-favourable technology

Despite connectivity issues, the roll out of apps in this project was the most smoothly run among the TADEP projects. The use of real time data management and the sharing of preliminary data with key stakeholders generated a successful feedback loop that was timely and relevant.

Some key lessons for future projects:

- Formal **assessment of project needs and resources at start of project** provided good preparation for MAD implementation.
- **Outsourcing application development** enabled shorter implementation time and allowed team members to focus on other project components (the trade-off was lower in-team capacity development).
- **Piloting should be conducted with local team members** in a setting that mimics the real fieldwork scenario. This will limit the potential for logistical issues not present in the pilot surfacing post-deployment and requiring application editing once in the field (with poor internet connectivity).
- Selecting **appropriately skilled team leaders** can help to support team members who might take a little longer to adjust to the new technology.
- Using MAD provided an opportunity to **streamline and coordinate datasets** with other in-country projects. This reduced duplication and burden on the community and improved the comparability of datasets.

7.2.4 Family Teams

Key Points

Project Title: Improving opportunities for economic development for women smallholders in rural Papua New Guinea

Project code: ASEM-2014-095

Location: Highlands and Bougainville, Papua New Guinea

Systems studied: Smallholder agribusinesses

Research Activities: Mixed methods small-scale baseline and endline survey to measure livelihood impacts.

Lead Institution: The University of Canberra

Partner institutions:

National Agricultural Research Institute (NARI)

Agricultural extension University of Technology (UniTech)

Pacific Adventist University (PAU).

Disciplinary focus: Biophysical and socioeconomic

Project stage for MAD implementation: After proposal and survey design and before commencement of data collection

Level of research staff experience with MAD: Limited

MAD activities: Transferral of paper-based survey to CommCare, app building training

CommCare package used: Community

MAD feedback mechanism: Data quality monitoring and real-time updates

Key lessons:

- This project benefitted from having a community of practice of app builders based in-country. The project tapped into the resources of its in-country partner NARI and recruited a trained staff member to support finalisation of the application and manage testing and deployment.
- Workflow of a paper survey can be very different to the workflow of the same survey in a digital format.
- It helps to have an understanding of the digital platforms capabilities and how best to make those work for the project's data collection tools.
- The added process and time spent translating paper into digital apps often leads to reflection and refinement of the survey. The outcome of this is a much more effective and efficient survey.
- Pilot data should be exported, downloaded and checked to make sure it is in an appropriate format for analysis before commencing data collection.
- Test data and users should be removed prior to commencing data collection.
- Dedicating a staff member to the role of Application manager helps to ensure that the digital data capture application is developed, tested and implemented and managed in a structured and efficient way.

Project Background

This project aimed to enhance the economic development of PNG women smallholders by building their agricultural and business acumen through:

- Agricultural extension,
- Improved banking,
- Saving and financial management skills,
- Increased access micro-finance, and
- Building gender inclusive decision-making capacity within the family and community.

The project aimed to achieve all this through the 'family teams' training approach.

The project investigated the expansion and out-scaling of the successful strategies used in ASEM/2010/052 into six areas of PNG with a focus on new commodity crops: i) sweet potato, coffee and vegetables in the Highlands; and ii) Canarium, cocoa and pearl shells in Bougainville/ Kavieng.

Project objectives

1. To examine the capacity development of women as community-based agricultural leaders
2. To explore ways in which communities can develop partnerships with the private sector, schools and training providers that are relevant to the local context and culture
3. To further develop the peer education model of agricultural extension
4. To examine the uptake and impact of a family team approach to farming for women and girls

Research questions

1. What are the critical skills, knowledge and processes needed to develop women's leadership in rural agricultural settings?
2. What are the opportunities and challenges in the development of private sector, school and training partnerships with farming communities?
3. What is the uptake and impact of the family teams approach for women and girls?
4. In what ways does peer-based agricultural extension support the development of women as learning facilitators?

More information about the overall project can be found on the ACIAR website (http://aciar.gov.au/publication/fs2016-asem/2014/095-0)

Perceptions and previous experience of MAD technologies

The project team had a small amount of experience with mobile data collection applications, though none using CommCare specifically. Staff had been previously collecting monthly reports using paper from the village extension leaders and had faced challenges in receiving that information in a timely manner. They liked the idea that CommCare could help to resolve this issue, however were concerned around the ability of some groups within the project to implement these surveys. The team had previously had issues in receiving accurate data through paper forms due to biased reporting. The project management decided that they would initially start using CommCare for the baseline/endline surveys, with the possibility of expanding its use to the monthly reporting forms pending initial performance.

Tailored support package for project

MAD Activities

CommCare was used by the project to conduct a mixed methods small-scale baseline and endline survey. This survey was used to measure effectiveness of project training and development activities on community livelihoods. The project adopted CommCare after proposal and survey design but before the commencement of data collection.

The questionnaires had previously been implemented in other projects and were well established as research instruments. Despite this, and to the team's surprise, the process of translating the paper forms into a digital platform provided an opportunity for them to reflect, revise and further streamline the questionnaires. Close support was provided to the team during the building phase, and pilot testing, deployment and data collection was managed by a NARI staff member with previous institutional-level training from AgImpact. The application captured data from 90 farmers across the project locations. Primary challenges were due to unfamiliar format of data exports during analysis, though this was overcome through support provision.

Needs assessment and planning

The late adoption of CommCare into this project meant that the team had to try and align this new technology with their existing plans. Time and resources had not been allocated for adopting this new technology, but the team were still very enthusiastic to try it out. Although the project allowed ample time between application development and deployment, the lack of a dedicated application manager and the steep learning curve when adopting a new technology caused a few issues. All staff trained to use CommCare were expected to implement MAD activities on top of their (already full) workloads. This led to low utilisation of the new skills and processes developed leading to them being forgotten or overlooked.

Training & Building

Application Building training was provided to 3 members of the Australian research team who took on the responsibility for building the initial application on top of their existing workloads. With limited previous experience in this area, the team faced a steep learning curve. The questionnaires had been developed and used in a prior project, so the team had thought it would be simple transfer of questions from the paper survey to the digital platform. What they didn't anticipate was how the added features and capabilities of the tool would facilitate further reflection and revision of their questionnaires. While improving the quality of the surveys, this added an extra step into the process that had not accounted for.

Testing & Deployment

During this same period AgImpact conducted institutional level application building and management training for a select number of employees from the PNG National Agricultural Research Institute (NARI). The training was provided to develop the capacity of in-country partners to assist ACIAR projects in adoption of mobile acquired data capture. As NARI was a key partner of Family Teams, the project hired one of the trained NARI staff members to support the piloting and deployment of their application in both the Highlands and Bougainville.

The appointed NARI staff member was the sole enumerator in the New Ireland sites. Two other enumerators from the Bougainville Women's Federation assisted him in Buka. He trained these new enumerators and reported that they were able to navigate the app well. As some categories listed in the questionnaire were not quite accurate for certain areas,

the NARI team member was able to adjust the forms in the field straight away. Other than a calculation error and manageable connectivity issues, deployment ran smoothly and approximately 90 farmers were surveyed using the CommCare application. All data were successfully uploaded to the server.

Monitoring & Evaluation

The team faced greater problems during the data management and analysis phase. The research team in Australia had not downloaded the data exports until the end of data collection which meant they were not familiar with the format of the CommCare data export. As a result, it took the team extra time to run their analyses. In particular, there were issues with using the data with statistical analysis software SPSS and the research manager ended up entering the values for all variables manually into the program.

Further issues arose with the data because the team had forgotten to register new mobile workers into CommCare and the real data had been captured using the test user. This meant that test data and real data appeared in the same spreadsheet. This issue was resolved by filtering the data by date and having the field team manually identify test cases.

User experiences

Nine feedback response forms were completed by the Family Teams project staff. Responses showed project staff mostly found Planning and Training phases 'Normal', but Building and Testing applications were more likely to be 'Difficult' (Figure 16). Two of the five staff members regarding Data Management and Monitoring found it to be either difficult or very difficult, reflecting the issues faced linking the data to SPSS and filtering out test data.

Family Teams staff rated AgImpact support as being either 'Useful' or 'Very useful' (Figure 17). The CommCare Support Page was rated useful by half the staff who used it, with the other half responding that it was not useful. Project staff that received support from other ACIAR projects found this support useful.

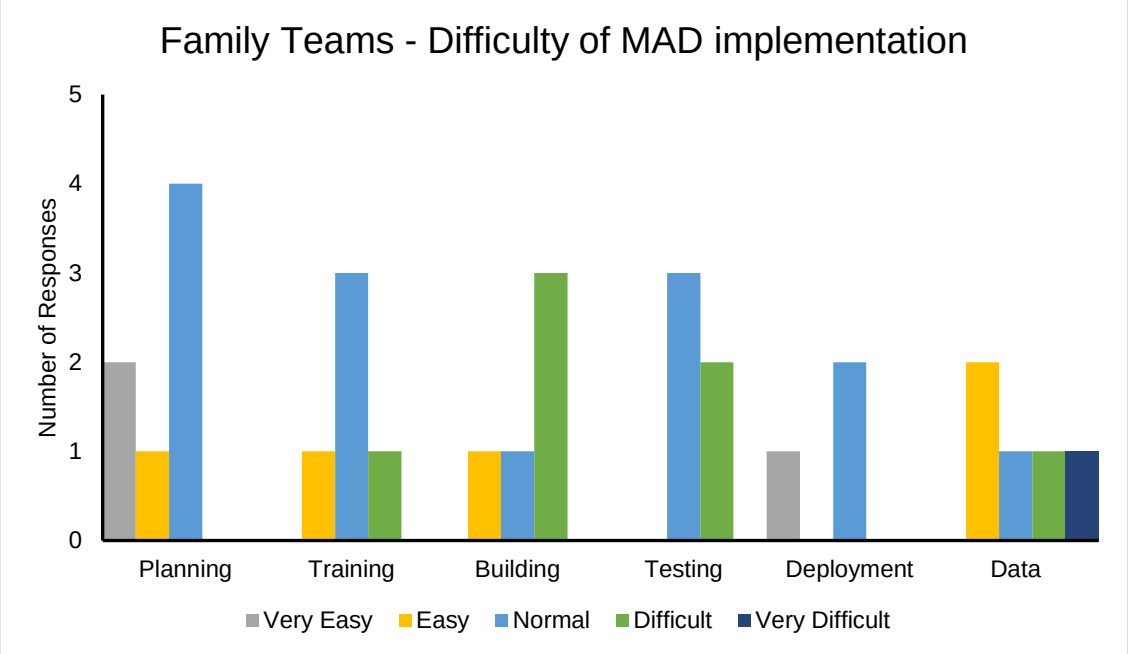

Figure 16: Ratings on the difficulty of various phases of MAD implementation from Family Teams project staff. Total number of responses = 9. Responses recorded as 'Not Applicable' are not shown.

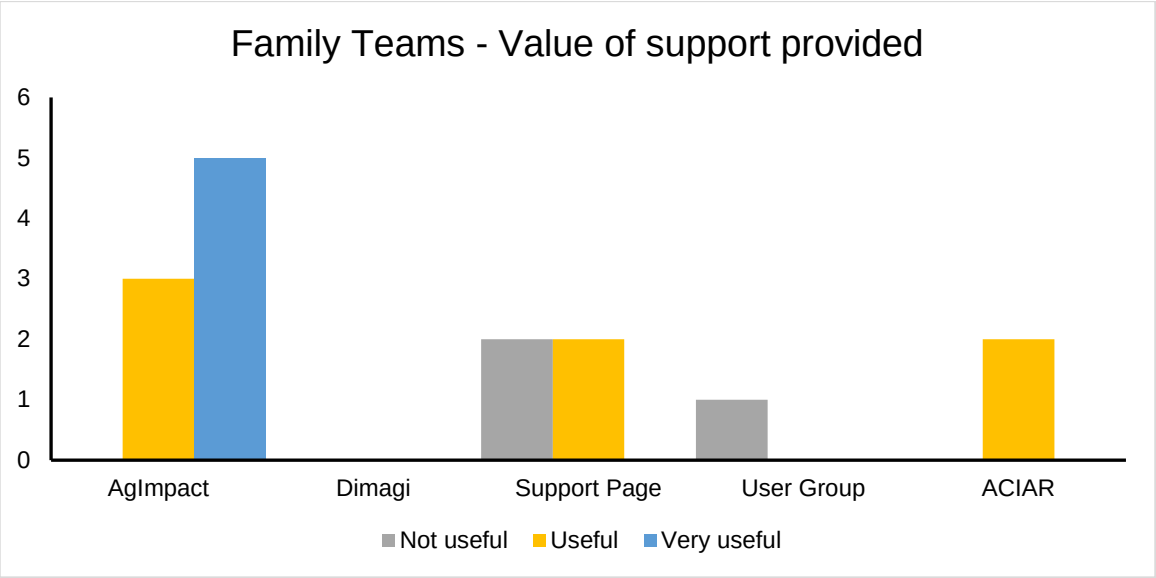

Figure 17: Feedback from Family Teams project staff responses on the value of various support provided during the MAD 2 SRA. Responses recorded as 'Not Applicable' are not shown.

Financial and time costs involved

Financial costs

The Family Teams project reported only $6 of operational costs to the SRA team during the project. This reflects a failure to fully report all operational costs associated with MAD implementation.

Time costs

AgImpact staff provided a total of eight support days to the Family Teams project. Most of these days were used in Planning and Training phases, with minimal support (i.e. zero to one day) needed for building, testing, deployment and data management (Table 20). Project staff spent 23 days on MAD implementation, with most going to application building and data management and monitoring (Table 20).

Table 20: Time spent (days) by AgImpact staff (support) and Family Teams project staff (implementation) in each phase of MAD implementation.

Support type	Activity	AgImpact staff (days)	Family Teams NARI staff (days)	Combined
Face to face	Planning	2	2	4
	Training	3	3	6
Remote support	Building	1	5	6
	Testing	1	3	4
	Deployment	0	2	2
	Data management / monitoring	1	8	9
Total		8	23	31
	Travel costs	0.6		

Sustainability of MAD capacity in-country

In addition to receiving project-specific training, the project leaders within the TADEP program indicated a preference for a coordinated effort to build institutional capacity within NARI to facilitate and manage Commcare related activities. As a result of these requests ACIAR allocated additional funds to AgImpact to provide CommCare institutional capacity building support to 5 NARI staff to leverage the support they will be providing the individual projects. A number of the trainees have now received CommCare certification and support ACIAR projects including the Family Team's project to implement digital data capture using CommCare.

The Family Team's project is an excellent example of the potential gain to ACIAR projects from having in-country MAD capacity. The community of app builders based in PNG were able to provide almost all the necessary support to Family Teams during MAD implementation process. Communities of practice are particularly relevant in programmatic settings whereby a series of projects are working toward a common goal. They provide opportunities to identify, create, store and share knowledge, reduce duplication, facilitate faster problem solving and enhance learning and performance among individuals and organisations.

Conclusion and key lessons

The Family Teams project faced a number of challenges initially due to late adoption of CommCare into their existing workflows and limited human resources. However, despite this, the project was able to successfully build and deploy their application in the field. Furthermore, they did so with medium levels of support from Agimpact, relying on the support of a trained NARI staff member who was engaged during the deployment phase. The ability to use existing in-country resources to support their project through deployment was of great benefit to this project. Without these resources it may not have run as smoothly.

Other than the need to allocate a **dedicated app manager** from the start, other lessons learned included the **larger time investment required upfront** for translating paper to digital. The team has previously used similar surveys for another project and were confident in their survey design. However, when faced with translating those paper surveys into a digital platform, they team was led to further reflection and refinement of their surveys. The outcome of which was a much more **effective and efficient set of questionnaires.**

The importance of **reviewing data sheets prior to data collection** was also an important learning for this project. Understanding how the data exports appear and how these will be used for analysis prior to implementation avoids further delays once data is collected.

7.2.5 Canarium

Key Points

Project Title: Enhancing private sector-led development of the Canarium nut industry in Papua New Guinea

Project code: FST/2014/099

Location: East New Britain, Papua New Guinea

Systems studied: Agroforestry: Canarium nuts

Research Activities: Trialling a range of interventions including market research, technical advice, capacity building, business mentoring and access to infrastructure for both private and public-sector stakeholders.

Lead Institution: University of the Sunshine Coast

Partner institutions:

Australia: University of Adelaide
Papua New Guinea: National Agricultural Research Institute

Disciplinary focus: Multidisciplinary; Biophysical (canarium resource practices) and socioeconomic (value chain analysis and market opportunities)

Project stage for MAD implementation: 2nd year of a 3-year project

Level of research staff experience with MAD: No MAD experience and limited technical capacity

MAD activities: Seedling status and weevil surveys, monitoring of canarium purchases, at small to medium scale with relatively short lead times

CommCare package used: Community

MAD feedback mechanism: In-person reviews and debriefing with enumerators

Key lessons:

- The potential of MAD for research is easily grasped by local partners who can develop and deploy CommCare applications independently with training
- Starting with simple day to day tools is an effective method to gain experience in MAD deployments
- Follow up training may be required if there is minimal access to support resources and partners need to maintain more complex apps
- Management support is critical to the success of MAD initiatives coordinated by local partners

Project Background

This project sought to expand markets and processing of Canarium nuts in East New Britain, Papua New Guinea. It aimed to achieve this by strengthening private sector capacity and engagement using nuts from existing trees. MAD Activities were coordinated by Mr Brett Hodges and Ms Emma Kill.

The specific objectives were to:

1. Assess the needs of the private sector to participate in the Canarium industry
2. Develop and undertake research-based interventions that address the needs of the private sector including smallholders, small scale entrepreneurs (especially women) SMEs, and large-scale processors
3. Develop an appropriate commercial model for a medium scale value adding factory for the Canarium industry
4. Create a model for public-private partnerships in the Canarium industry in PNG

More information about the overall project can be found on the ACIAR website (http://aciar.gov.au/project/fst/2014/099).

Research activities

This project took a whole of value-chain approach. Its activities included researching markets, providing technical advice, building capacity, mentoring businesses, and giving private and public-sector stakeholders access to infrastructure.

Perceptions and previous experience of MAD technologies

Neither the project's Australian staff or the team at NARI's Kerevat office had any previous experience with MAD. All participants had used a smartphone but not all had permanent access to a mobile device or laptop. None of the staff had regular internet access.

Tailored support package for project

Only one 4-day app building training session was provided in Kerevat. Very little remote support was requested. This was largely because infrequent internet connection meant researchers could not exchange emails effectively. Likewise, the available internet connection at the office could not support a Skype conversation.

Despite these issues, four CommCare applications were deployed. The first application enabled the collection of customer data and receipt provision on regular "buying runs" where canarium nuts were purchased for the on-site factory. A short survey on the viability and production capacity of elite seedlings, and a similar survey on the degree of weevil infestation in seedling stock were produced by students in collaboration with senior scientists. Both surveys were intended as rolling rather than intensive data collection activities. Food technician and factory manager Dalsie Hannet was assisted to create an application to monitor factory stock and processes.

Planning

The applications the team wanted to build were relatively simple, so planning was combined with app building training and was very brief. It involved small group discussions to create a Word document with questions to be included in the forms. The discussions centred around the practicality of long questionnaires under local conditions, and the questions that farmers would be able to answer versus the information the researchers would ideally like to collect. Only one of the surveys contained more than a dozen questions per form.

Training, Building & Testing

Though only 6 people were scheduled to attend the app building training, the first day saw 16 participants at the venue. Everyone in the Kerevat office was interested to learn new research skills. For practical purposes the trainees were divided into smaller groups, where each had allotted time with the instructor.

All four applications were built by these small groups of local staff over four days, based on their areas of interest and expertise. While some members of each group were content to watch and learn, there were "drivers" who completed most of the app building. At least two of the participants continued work at night after the training using their own mobile data credit.

Interview-style testing was conducted as a group, and some groups switched to test each other's applications. Many excellent observations were made during this process and changes were implemented on the spot by app builders to address the concerns identified by colleagues. The trainees who picked up the concepts more quickly often stepped in to help other groups with their challenges.

Godfrey Hannet, one of the most enthusiastic participants, was also in attendance during the second NARI institutional training session provided within the wider MAD 4 TADEP SRA. Here he was able to join for two days to learn how to resolve some issues he had encountered after deployment.

Deployment

The app builders within the project took responsibility for training enumerators. There were only a few NARI staff collecting data so this process was informal and conducted in both the office and factory. Data collection began within weeks of the apps being built, using smartphones owned by the enumerators or their colleagues. Three of the CommCare applications that were built during the training were still being used by the staff at NARI Kerevat at the time of reporting.

Monitoring & Evaluation

Regular monitoring of data was not possible because of the unreliable internet connection. Data was downloaded in bulk when the connection supported it, and was reviewed by researchers. Problems with the data were then addressed with enumerators directly, while in the office, with data cleaning done in the Excel exports. Local researchers were all familiar with Excel and found the format of the exports suitable for their analysis with no additional tools required.

User experiences

As described earlier, the internet connectivity of the Canarium project team was extremely poor. Among other tasks, this restricted the team’s ability to complete the feedback forms evaluating the difficulty in implementing MAD and the value of various support provisions. Only one Canarium project member was able to complete this feedback. Their response Indicated the Training and Building was ‘Difficult’ (Figure 18) and that the support provided by AgImpact was ‘Useful’ (Figure 19). Planning and Testing phases were rated as ‘Normal’ and no other support mechanisms were used by the respondent.

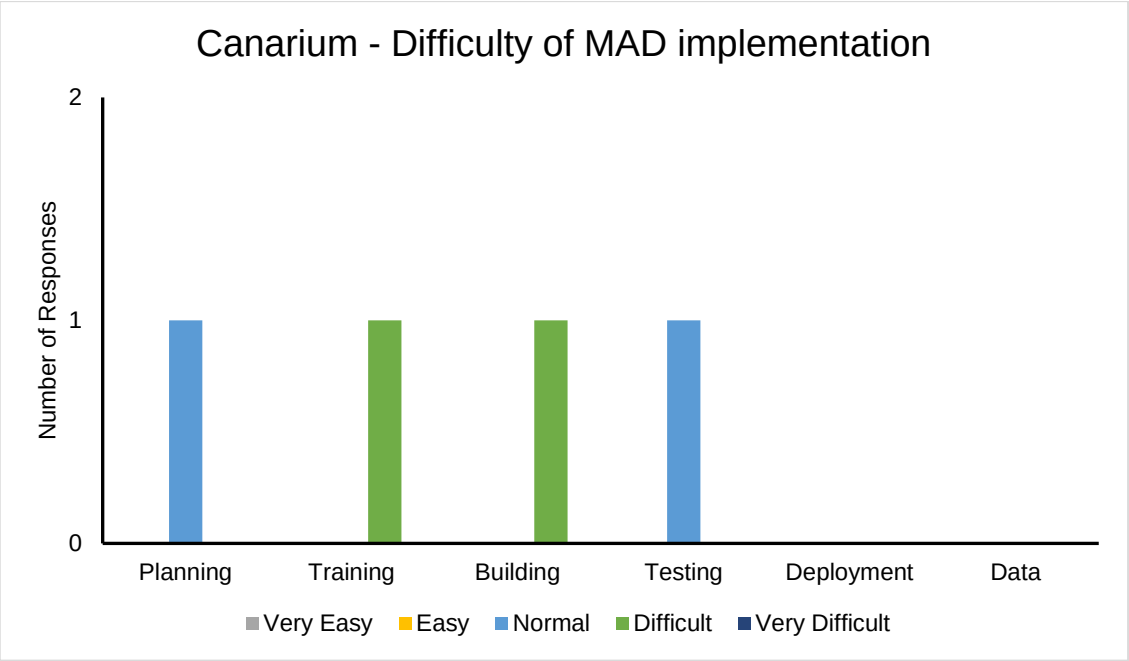

Figure 18: Ratings on the difficulty of various phases of MAD implementation from Canarium project staff. Total number of responses = 1. Responses recorded as 'Not Applicable' are not shown.

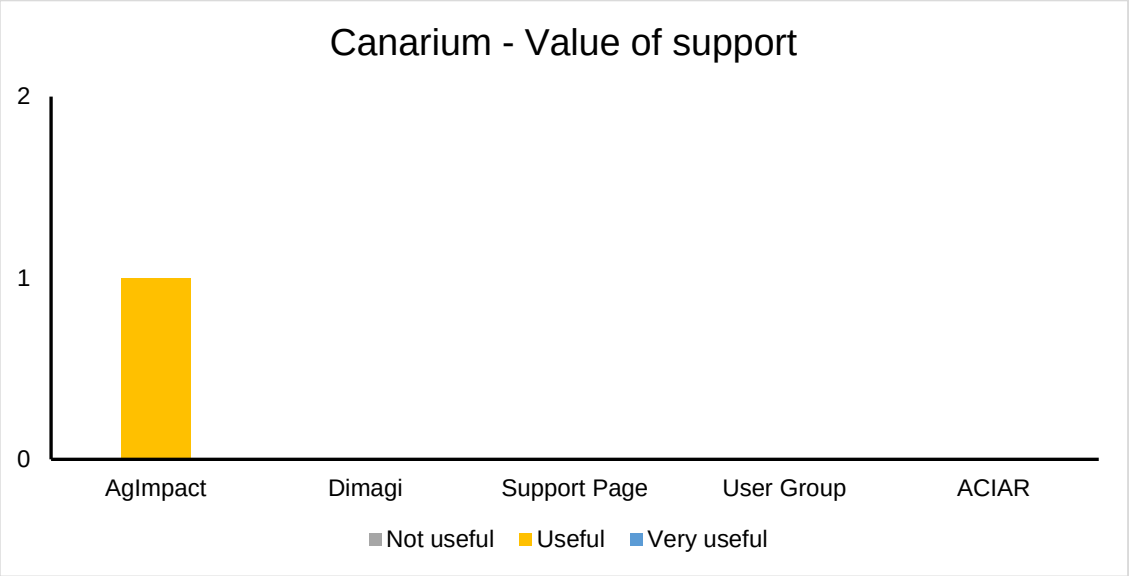

Figure 19: Feedback from Canarium project staff responses on the value of various support provided during the MAD 2 SRA. Responses recorded as 'Not Applicable' are not shown.

Institutional data objectives

What were the goals?

MAD Coordinator Brett Hodges was primarily concerned that local staff should receive the app building training and have ownership over MAD adoption to promote sustainability for the initiative. There were some doubts about the practicality of mobile devices in the local environment, especially regarding rain, reliable electricity for charging, and theft. The main driver for the project to adopt MAD technology was to increase the quality and security of their data collection. Few formal processes for data quality and security of collection were in place. The team had previously experienced significant losses of paper data to rain and fire, compounding concerns around secure collection and storage.

Institutional support for MAD

By the end of the support period, the researchers felt that they had more comprehensive and accurate records in the areas where digital data collection was implemented. In particular, senior economist Carson Waai said that financial records had improved. NARI staff were much better able to track not only the quantities of nuts that were being purchased, but also the origin of the nuts and how production issues could be related to the source of the nuts.

There was an advantage in offering app building training to the local scientists. Kerevat staff were able to design, build, deploy and maintain their own MAD tools with limited training. They appeared very grateful for the opportunity to learn these skills and were enthusiastically putting them into practice for their own research. With in-house capacity to make alterations, the use of these tools was sustainable beyond the life of the project.

Social scientist Brett Hodges noted that there was a general boost to the team's confidence in being able to master CommCare basics so rapidly, and produce working questionnaires. This was especially so for older scientists who had minimal exposure to mobile devices in the past.

To date, nearly 600 Canarium purchases have been recorded using the "Buying Data" app, in much greater detail than was previously recorded in an unstructured way on paper.

Institutional challenges to MAD

The major challenges for the NARI Kerevat team were lack of access to electricity, internet. Problems with the local power supply resulted in regular, sustained load shedding for all of 2017. A variety of internet connections were made available (satellite, mobile hotspots, personal phones) to limit times when no connection was available. However, occasionally none of these were functional. In periods where there was no electricity for charging devices, the team used paper backups and subsequently entered the data into the app.

Impact on participants

Social scientist Emma Kill felt that mobile devices were intrusive and made respondents nervous during qualitative interviews in the markets.

Inclusiveness

App builders reported that while younger staff were excited to learn to use the apps as enumerators and required minimal training, some of the older staff were hesitant and needed additional training and reassurance.

Limited capacity & training

Though the team were enthusiastic about the application for monitoring factory processes, it required more complex coding than the other apps. Regular changes that this monitoring app needed exceeded the capabilities of the trained staff.

NARI Kerevat staff several times expressed how keen they were to receive additional training for their primary app builders to improve their skills. However, due to a disconnect between the local partners and project leaders, an in-country training session could not be organised.

Financial and time costs involved

Financial costs

No data about financial costs was reported by the project. One smartphone was purchased for the factory, but the majority of financial outlay was for the purchase of mobile data, for both app building and data downloads.

Time costs

A total of eight support days were provided by AgImpact to this project (Table 21). These were only used during planning and training as poor internet connectivity meant staff could not access remote support. An additional 2.4 days were logged as travel and logistics. Canarium project staff did not report sufficient data on their time allocation to MAD adoption.

Table 21: Time spent (days) by AgImpact staff (support) and NARI Canarium staff (implementation) in each phase of MAD implementation.

Support type	Activity	AgImpact staff (days)	Canarium staff (days)	Total (days)
Face to face	Planning	1	n/a	1
	Training	7	n/a	11
Remote support	Building	0	n/a	0
	Testing	0	n/a	0
	Deployment	0	n/a	0
	Data management / monitoring	0	n/a	0
Total		**8**	n/a	**12**
	Travel costs	2.4		

Sustainability of MAD capacity

The Canarium project overcame serious resource challenges to implement several MAD applications. These increased the accuracy of their data collection and the local researchers' efforts to achieve this are commendable. The enthusiasm of local partners for MAD adoption was the primary factor in their success. Another critical factor was that the local team did not overreach with complex questionnaires in their first attempts to build CommCare applications. This choice to keep things simple early on enabled them to experience the full spectrum of activities involved in testing, training and deployment without getting overwhelmed. Further app building training for key staff would position the Kerevat office to provide sustainable MAD support for future ACIAR projects in the area.

Conclusion and key lessons

The key lessons learned in the Canarium project were:

- **Allowing local partners ownership** of the MAD adoption process is a useful strategy for sustainable adoption and in-country capacity building
- Starting out by building **simple tools with short deployment cycles** that help with day to day project activities rapidly increases experience and confidence with the various aspects of MAD implementation

- While a single app building training of four days enables an enthusiastic team to build and maintain simple applications, **confidence with more advanced techniques comes after a second training session**.
- If Australian researchers cannot be in-country, then **additional communication** is required to stay up-to-date with and guide the progress of local partners
- **Management support and communication is critical** to sustainably drive MAD adoption.

7.3 Discussion

7.3.1 Assessment of Dimagi maturity model

Based on the experiences and lessons from the MAD 2 SRA, the Dimagi Maturity Model was found to be unsuitable for guiding the support needs of ACIAR research projects. This is largely due to the model being designed for large NGO development programs rather than smaller scientific research projects. The larger development programs undertake much larger-scale, multi-site and longer-term data collection compared with the typical ACIAR projects (i.e. those represented in the MAD 2 SRA). The significance of these points is that the model assumes a capacity using an iterative approach to CommCare development and capacity building within projects and their relevant institutions that doesn't exist in the typical ACIAR context. Tolerance for lower quality data from early stages of maturity are also far lower in ACIAR projects – further challenging this iterative approach. In its place, AgImpact developed its own needs assessment in the MAD 2 SRA consisting of a series of pre-engagement questions which then informed tailored 'support plans' for each project.

The design of the Dimagi Maturity Model

Programmatic, based on iteration over time

Dimagi's Maturity Model advocates for an iterative approach to implementing MAD in research for development. It recommends early development and testing is focused on very small scales and that full deployment occurs after a number of field activities have already taken place. This provides opportunities to develop field staff capacity and application quality before full and proper data collection occurs. Underlying this approach is an assumption that data collection events are ongoing and therefore that opportunities exist to test out MAD implementation without the data being needed for decision making, management or publications.

How the model stages propose data collection and its use

Within its five stages of maturity, data collection that is suited for 'regular application' does not begin until the Stage 3 (Table 22). The first two stages before full MAD deployment ('Proof of concept' and 'Stabilized [sic] and field-tested system') are not supposed to involve any application of the data being collected (Table 22). These two stages respectively suggest that 'data collected but not used' or 'data accessed but rarely applied'. It is only in the third maturity stage of the model that validated data is collected and can be applied to make decisions (i.e. congruent with data suited to form the basis of a peer-reviewed publication). The final two stages of the maturity model involve scaling out the refined and validated MAD activities and ongoing stable use of MAD in improving program management.

Table 22: Dimagi's CommCare Maturity Model matrix (adapted from Dimagi's website). Program areas represent aspects of MAD implementation while stages indicate progress towards self sufficient and fully functional use of MAD applications in a program context.

Six program areas	**Stage 1:** Proof of concept	**Stage 2:** Stabilized and field-tested system	**Stage 3:** Validated system delivering value to frontline workers	**Stage 4:** Packaged, repeatable system for scale up	**Stage 5:** Ongoing, stable use of system providing value at scale
Program Design	New content, small number of use cases	Refined content based on field iteration	Validated content used by frontline workers	Frontline worker content stable. New supervisor content created and iterated	Additional use cases added to technology platform
Data Driven Management	Data collected but not used to improve workforce	Data collected, but rarely applied	Data periodically used for performance improvement or evaluation	Data regularly used for performance or evaluation	Data used to improve program design, increasing levels of automation for data driven management
Technical Support	Limited technical capacity among program staff	Technical resources existing and trained, starting to use the training in field	Technical resources certified and regularly conducting basic support	Technical resources fully capable, but still needing limited external support	Technical resources fully capable of managing program independently of external support
Training and Implementation	Training and implementation policies not yet modified for mobile tech	Adapted training & implementation policies to mobile tech	Training and implementation policies for mobile tech used in practice	Training and implementation practices replicable under cascaded approach	Training and implementation practices institutionalized and improvement can be rolled out iteratively
Scale	Designing and demonstrating with small number of users	Increasing adoption with frontline workers	Fully deployed with specific target users (or deployment experience). Users demonstrating value	All processes documented and expanding to additional users	Fully deployed to target user base
Sustainability and Strategic Alignment	Focus within single organisation with single source of funding	Building awareness, buy in, and support of the program. Aligning to national strategy	Seeking additional funding based on demonstrated value. Program aligned with national strategy	Expansion funding secured. Expanding in line with national strategy	Core solution in national strategy receiving core programmatic funding.

Assumptions about field staff

The model assumes field staff are employed in the program or project on an ongoing, permanent basis. As such, it is designed to invest a lot of time and resources (particularly in early stages) on developing MAD capacity among field staff or 'frontline workers'. These frontline workers are also at the centre of the iterative and adoption process early on. For

example, Stage 2 proposes program design around ‘refined content based on field iteration’ while suggesting the scale at this stage is ‘increasing adoption with frontline workers’. This heavy input from frontline staff assumes staff are working in the field collecting data before an application has been fully built or beta tested.

It also places emphasis on spending early stages building awareness and buy in from the wider organisation while ACIAR projects require buy in among partners to be already established at the beginning of projects.

Why is it unsuitable for ACIAR?

The Dimagi Maturity Model is unsuitable for ACIAR projects. This is primarily because it assumes an operational length, scale and resource base beyond that of most ACIAR-supported research. Therefore, unless ACIAR transitions to fewer, larger and more long-term and complex projects the Maturity Model is of limited use. Currently, data collection in ACIAR projects is undertaken in a ‘single-serve’ fashion rather than ongoing as is presumed by the model. Data collection is also smaller in scale than what is assumed and does not usually include significant scaling-out as part of the funded research project. Furthermore, the quality of data collected during these single-serve activities within ACIAR projects needs to be high enough to form the basis for peer-reviewed scientific publication. This leaves little room for data issues during collection. The cost of capacity building among field staff is relatively higher for an ACIAR project budget than a typical large-scale NGO development program. Finally, as these field staff are usually from partner organisations or local contractors, the return on such investment in MAD capacity is minimal. This makes it difficult for ACIAR projects to focus early MAD implementation on field staff training (as is suggested by the model).

Data collection and field staff

ACIAR projects can generally be described as having a series of interrelated yet distinct data collection activities. In the five case studies included in the MAD 2 SRA, these tended to be one-off or baseline/endline household surveys (Vietnam Vegetables, MyRice, Bougainville Cocoa) or multiyear on-farm field trials (MyRice). In some cases, ongoing monitoring with participatory elements featured (e.g. Vanuatu Beef), however these too were limited by the length of the project. On the other hand, the Maturity Model assumes an ongoing monitoring-style data collection that provides numerous opportunities for field testing MAD applications. For most ACIAR projects, data collection occurs only a handful of times (e.g. one survey data collection and one field trial data collection per year, three years of project). This is far fewer field data collection activities that are assumed by the model, meaning the iterative development approach is impractical within existing field activities.

One solution to this is to run dedicated field-testing activities for the applications. However, ACIAR projects tend to rely on contractors or partner organisations for fieldwork data collection. For example, MyRice used staff from in-country partner organisations while Vietnam Vegetables contracted private company enumerators for their surveys. The cost of running dedicated fieldwork for testing and re-iterating MAD applications is therefore charged at an external (rather than internal or in-house) rate. Furthermore, this additional cost would need to be covered by project budgets, and those participating in the MAD 2 SRA had not provided for this in their planned activities. In addition to this, field staff that gain MAD capacity also fail to provide the return on investment that is assumed from the model. Ultimately, this meant that the early iterative development of MAD applications as proposed by the Maturity Model (which focus on the use of field staff) was not suited to the ACIAR project context.

Scale of data collection

Another issue with the Maturity Model relates to its assumptions around the scale (and scale-ability) of MAD applications and their utility within a project. The scale of NGO development projects upon which the model is based would equate to over 100,000 households in a single year being used as a pilot for MAD applications. In contrast, in the final deployment phase, projects that conducted household surveys (e.g. MyRice, Vietnam Vegetables) collected data from between 2000 and 8000 households. This means the value in an iterative approach in terms of fine-tuning applications is lesser than is the case for the projects that were used to build the Maturity Model.

Furthermore, the ACIAR projects involved in the MAD 2 SRA did not have dedicated scale-out phases where Stages 4 & 5 of the Maturity Model matrix (Table 26) could apply. Instead, data collection post-deployment occurred at the same scale throughout the SRA in all projects. This was typically in a limited number of sites (e.g. two provinces in a single country) and over only 2-5 years. Without having these scaling-out stages, the MAD 2 SRA projects were only able to reach Stage 3 of the Maturity Model. This meant any further development of the applications, or the implementation of mobile acquired data that was collected through application, would have to take place outside of the projects themselves.

Planned use of data

Another important point of difference between ACIAR projects and typical Dimagi-supported NGO programs is the planned use of data. ACIAR projects are first and foremost required to deliver rigorous, peer-reviewed scientific research that can be published. This means the 'valuable' data collected in these projects must be considered appropriate for scientific academic research use. The typical nature of data collection in a Dimagi-supported project is ongoing, with data collected over many years. This means Dimagi-supported projects have a greater ability to tolerate low quality data in early stages of MAD implementation. An ACIAR project cannot, for example, afford to drop baseline survey data because a MAD application was not properly designed to integrate with subsequent data collection applications.

However, this is precisely what is assumed in the Maturity Model. To illustrate this point, the model matrix (Table 26) suggests that 'valuable' data collection does not occur until the Stage 3. Stages 1 and 2 respectively propose that data be "collected but not used" or "collected but rarely used". As previously outlined, ACIAR projects generally collect data in a single-serve manner and do not have built-in opportunities for field testing where resulting data will not be used. This means the first two Stages in the Maturity Model (which are meant to be carefully navigated over time) must be dealt with quickly and with little field-testing. Therefore the improvements in MAD application quality that are meant to occur via the iterative approach cannot take place and other approaches are needed.

An alternative model

Instead, AgImpact developed a different support approach which focused more on pre-building skill development and in-field support for changes "on the go". This was not an optimal method of implementation but was far more suitable for the ACIAR projects than the Maturity Model approach. Details of this model are included in methodology (Section 4.1) and each project's tailored support package reflects how these were implemented in the MAD 2 SRA.

7.3.2 Value add of apps to ACIAR projects

The results of the MAD 2 and MAD 4 TADEP SRAs support the case that MAD apps can add value to ACIAR projects. Based on the case studies presented in this report, common benefits from MAD adoption include:

- Reduced survey times (when doing long-complex surveys)
- Better quality control as data is being collected
- Improved relationships with enumerators and communities
- Rapid feedback for participants
- Improved vehicle for extension delivery
- Enhanced in-country capacity development

Reduced survey times

The Vietnam Vegetables and MyRice case studied both demonstrated that MAD applications can reduce survey times. Both studies both involved long, complex surveys that were able to take advantage of CommCare's skip logic and repeat groups to reduce survey time. In the case of Vietnam Vegetables, the time taken to complete a single survey was reduced by 2 hours (40%). Likewise, the MyRice project reported survey times were reduced by 1.25 hours (50% of total survey time) and that this amounted to 39 days of fieldwork being saved. In the context of voluntary participation of farmers in research projects the reported time saved in these projects is of enormous benefit. By adopting MAD technologies, both enumerators and farmers can have improved experience participating in research projects, leading to better relationships especially in ongoing or longitudinal studies. In contrast, more simplistic surveys such as the Pakistan Dairy value chain survey did not report such sizable time saving – indicating that a scale threshold may exist for such benefits to arise.

In both the Vietnam Vegetables and MyRice cases, the complexity of the surveys meant that pre-deployment required significant investment of staff time. Vietnam Vegetables reported 42 days of staff time was invested prior to deployment. For the MyRice project, the figure reported was 50 days. This offset some of time that was saved in the survey fieldwork, but subsequent (non-reported) time saving during data entry and analysis would most likely have meant overall time saving had taken place. In addition, the pre-deployment time included upskilling staff from no prior experience in CommCare. Now that both projects and their relevant institutions have this in-house capacity, future MAD applications can be built and deployed with much less time investment. What this experience suggests is that projects with sufficient survey length are able to save research staff time or financial resources when adopting MAD technologies for the first time, and that this saving will increase as in-house capacity is developed. Smaller surveys (such as those for Pakistan Dairy and Vanuatu Beef) are less likely to save resources when adopting MAD without in-house capacity. Additional benefits to MAD adoption beyond this time saved must also be factored in when project leads are deciding whether to adopt MAD technologies.

Improved data collection quality

In addition to the reduced survey times, adoption of MAD technology resulted in projects benefitting from improved data quality. MAD tools allowed project leaders to monitor incoming data (usually on a daily basis) and identify issues as they arose. This form of monitoring was undertaken in all MAD 2 case studies, with project leaders calling enumerators or field staff to clarify any issues. In addition, some projects (such as Vietnam Vegetables) reported that MAD adoption reduced data loss and all noted time taken for data entry from paper surveys was eliminated.

However, one consequence noted by Vanuatu Beef project lead Dr Simon Quigley was that field staff missed out on the experience working directly with data in Excel. In contrast, Pakistan Dairy lead Dr David McGill suggested that field staff were more comfortable accessing and analysing the data themselves because of the shared project space within CommCare HQ. These divergent experiences of how immediately digitised data affect field staff suggests that project leads should consider planned approaches to data management post-fieldwork when adopting MAD technologies.

Rapid feedback and improved relationships

Using CommCare's interactive capability to engage respondents and to provide customised extension advice in near real time emerged as a key value addition of these apps to projects. Some of the most successful MAD implementations were those in which farmers or participants were excited by how the technology added value for them. This was most often in the form of rapid feedback. For example, Vanuatu Beef used pre-programmed market data along with cattle live weights to provide farmers with accurate estimation of the price they would receive for their cattle at each local buyer. According to project lead Dr Simon Quigley, this changed the relationship with participants dramatically and led to an extremely favourable perception among the community. Even when projects weren't able provide feedback immediately, participants favoured the use of tablets as they believed the technology would speed up feedback provision (e.g. Bougainville Cocoa). To get the most out of this opportunity for rapid feedback, it was crucial this use of MAD was built these into project aims from the start. Instituting feedback loops and communication channels was critical, but took additional time and effort beyond completing essential data collection app design. However, taking the time to develop real time information dissemination in conjunction with frontline staff greatly improved project relationships. Allowing adequate time for planning and testing these systems ensured their implementation in the field was successful.

CommCare for extension delivery

The best assessment of rapid feedback in the MAD series was the pilot study of extension delivery in Pakistan Dairy project. This activity, conducted with 320 dairy farmers in Pakistan, found an overwhelming majority of respondents (farmers and extension workers) preferred the interactive CommCare app for extension delivery. Interestingly, a simple digitised version of the paper factsheet was not thought to be superior to the paper fact sheet as the farmers preferred to have the option to take the printed material home with them. While the capacity for interactivity and real-time information dissemination is a key value proposition, translating existing systems and workflow from paper to digital without fully tapping into CommCare functionalities produces only marginal benefits. While there may be efficiency gains in terms of time saved, meaningful engagement depends largely on project design.

Enhancing digital in-country capacity building

Capacity building appeared to be one of the major value adds from MAD technologies during both SRAs. Several case studies indicated genuine capacity development within their partner institutions or field staff as a result of MAD implementation. The MyRice case study described a 'community of practice' among the team of app builders, known as the 'A-ladies'. These staff members were well-organised and largely self-directed in the building of an impressive nine applications deployed in three countries. Their work reportedly led to the establishment of a unified data format across IRRI more generally,

and they are now subscribed to CommCare with plans to use it in future partnerships. As such, the involvement of MyRice in the MAD 2 SRA has led to established app building capacity within IRRI which is now cascading into other non-ACIAR projects.

Another example from the Pakistan Dairy project shows how MAD adoption can enhance traditional capacity building. Most ACIAR projects afford in-country staff the opportunity to refine their research design skills with assistance from a senior Australian researcher. However, Pakistan Dairy project lead Dr McGIll reported that when building MAD apps for even simple survey work, his team were able to engage in much deeper discussion around survey design and data needs. Dr McGill described conversations during planning sessions where staff considered trade-offs implicit in enumerator skills, length of surveys, desired data, and research project needs. According to Dr McGill, traditional paper-based surveys simply did not spark the same conversations among project staff.

Experiences from MAD 4 TADEP SRA provided additional perspective on the benefits of MAD capacity building. The Family Teams project showed how the CommCare app builders in PNG's National Agricultural Research Institute (NARI) were able to provide support directly to an ACIAR project. A NARI staff member trained through institutional-level support provided direct assistance in app building and deployment for the Family Teams project. This immediately demonstrated the potential for in-country capacity to add value to ACIAR activities. The Sweet Potato project showed how capacity can have flow-on benefits to other institutional activities. The project partners FPDA received training in CommCare and then proceeded to organise their own internal app workshop to implement MAD technology in another research activity. The institutional interest / enthusiasm in adopting MAD apps is therefore a key factor in the benefits for capacity development. Examples from Canarium and PNG Cocoa projects provide counter examples where lack of logistical and institutional support for staff undergoing MAD training meant benefits were significantly limited.

Based on the case studies reported in this document, MAD technologies can be said to enhance existing capacity building that occurs in collaborative research projects, while also allowing new capacity development that benefits not only ACIAR projects but other partnerships and in-country activities. The degree to which these benefits are realised depends mostly on logistics (e.g. internet connectivity) and institutional enthusiasm / interest for the development that MAD can allow. Even when these factors present challenges, MAD adoption can still prove empowering for in-country staff and lead to enhanced career opportunities (for example, in the Bougainville Cocoa case study).

Digital literacy skills

In many countries where ACIAR projects operate, the tablet or mobile could be the frontline staff's only device. In the MAD 4 TADEP SRA (in particular) testing and deployment often facilitated the first sustained interactions with computing technology and the Internet for NARI staff. While this presented challenges (such as in PNG Cocoa), it also provided opportunities to give field staff new skills and a greater sense of pride in their work (such as with Bougainville Cocoa). In cases where this was managed well, the benefits can be substantial.

Data collected on the digital competencies of enumerators across the projects were collected during the SRAs to measure the growth in digital literacy after MAD adoption.

The digital competencies required to navigate the CommCare interface, register cases and troubleshoot issues from the field varied between projects. The table below shows the proportion of respondents from each project in each Digital Index scores (1 = low to 3 = High) before and after the MAD 2 SRA. Based on these figures the Vietnam Urban and Pakistan Research teams had the highest digital index scores of those involved in the study, whilst the Pakistan Extension had the lowest. The Vietnam Urban team worked in urban Hanoi and Ho Chi Minh City and had a high degree of familiarity with smartphones and even a Vietnamese language communication app. Pakistan Dairy (Research) team, on the other hand, had the least exposure to internet and digital technology.

Changes from baseline to endline in Table 27 show the greatest growth in digital index score was in the Pakistan Research, Vanuatu Beef and Vietnam Rural project teams. This helps demonstrate the digital literacy benefits of training and implementation on the capacity of the teams. Both Pakistan Research and Vanuatu Beef teams had enumerators who were part of the wider extension network, and not employed solely for data collection. Therefore, investment in their training has a bearing on the change in confidence levels – something worth keeping in mind when considering which staff should receive training.

Table 23: Comparison between baseline and endline measures of enumerator digital index for the lowest three index scores

Project	**Proportion of project respondents per digital index score (%)**			**Total count (n)**
	1	2	3	
a) Baseline				
MyRice	0.0	100.0	0.0	8
Pakistan Dairy (extension)	0.0	90.0	10.0	10
Pakistan Dairy (Research)	20.0	60.0	20.0	5
Vanuatu Beef	0.0	100.0	0.0	5
Vietnam Vegetables (Rural)	5.0	70.0	25.0	20
Vietnam Vegetables (Urban)	3.6	10.7	85.7	28
b) Endline				
MyRice	0	100.0	0.0	8
Pakistan Dairy (extension)	0	90.0	10.0	10

Pakistan Dairy (Research)	0	44.4	55.6	9
Vanuatu Beef	0	60.0	40.0	5
Vietnam Vegetables (Rural)	0	15.4	84.6	13
Vietnam Vegetables (Urban)	0	5.3	94.7	38

7.3.3 User experiences

Case studies from both MAD 2 and MAD 4 TADEP showed most research staff found the Building, Testing and Deployment phases the most difficult. How difficult each phase was depended on the project and individual staff member experience. For example, staff in the Vietnam Vegetables project did not report any phases being 'Difficult', but were less likely to rank testing and deployment phases as 'Easy'. Likewise, less Bougainville Cocoa staff reported Building and Testing phases as 'Easy' than other phases, indicating these were relatively more difficult than other aspects of MAD implementation. In both cases, project staff found all MAD implementation work to be either easier or the same level of difficulty as their regular work.

The Pakistan Dairy, Vanuatu Beef, and MyRice project staff all reported at least one phase of MAD implementation as 'Difficult'. These were generally in building, testing and deployment. A notable exception to this was the Canarium TADEP project, which found training very difficult largely due to logistical challenges meaning a second training was not conducted (Section 6.5.4). These results suggest that when adopting MAD technology, research projects should be aware of the additional challenge to staff during building, testing and deployment phases, and both prepare and support staff accordingly.

All projects reported the external support provided by AgImpact to be very useful. Generally, this external support was considered the most useful of all those provided. This is unsurprising given that such support was tailored to each project's needs. Other key support mechanisms included the CommCare support page, which appeared to be considered useful by most projects. Support provided by other ACIAR projects was rarer but also considered 'Very useful' in most instances. These results indicate that tailored external support for MAD adoption is highly valued by project staff, and more usually useful than other self-directed support options (e.g. CommCare support page). Given the value placed by staff on support from other projects, where possible, ACIAR should encourage projects to seek assistance within the ACIAR community as an accessible and free source of support. A recognition program (e.g. nominating researches as 'MAD leaders' within the ACIAR community) may also help allow future researchers to seek out those with MAD adoption experience for advice in the future.

7.3.4 Evaluation of scaling methods

During the MAD 2 and MAD 4 TADEP SRAs, four distinct approaches to scaling out MAD adoption were implemented. These included:

1. Introduction training: more people at less depth (RAID training workshop)
2. Intensive training: fewer people at greater depth (NARI training)
3. Scaling through programs: (TADEP and AVCCR)

4. Scaling through projects champions: (Vietnam Vegetables and GFAR)

Among these four options, each had their own strengths and weaknesses. RAID training had a wide reach for comparatively less time investment (2-days). However, while well-received, this training effort did not lead to adoption and advanced use among most trainees and projects. On the other hand, institutional training with NARI led to adoption with other projects with the EU and UNDP, even though this only trained 5 individuals and only four became certified application builders. The TADEP program allowed much better capacity building in PNG as so many projects were using the platform at the same time. Finally, developing the Vietnam Vegetables project as a champion within the University of Adelaide has meant project staff capacity was retained and redeployed on other research projects.

Collectively, these efforts led to an impressive adoption among a wide variety of projects and institutions from a small research series. In comparison to other documented 'ICT4D' studies, the adoption rate of new technology in the MAD series was impressive.

Introduction Training: more people at less depth (The RAID workshop)

The RAID training workshop was a two-day training session in MAD technologies held at The University of Melbourne in February 2017. This event was co-sponsored by the RAID Network (Researchers in Agriculture for International Development), an early-career researcher network based in Australia. Trainees were recruited by RAID through promotion via the Crawford Fund and university linkages. In total, there were twenty-three researchers trained in MAD app building using CommCare. The training delivered introduction to basic CommCare features and issues around deployment in a research for development context (e.g. internet connectivity, device management, data security issues, etc). Trainees did not have time to work on their own capstone applications during the training given its short length. Two thirds of trainees (67%) providing feedback said they felt 'confident' or 'very confident' in using MAD apps after the training. Several responses indicated that attendees would have liked to have time during training to build applications specifically for their projects.

Due to the partnership with RAID, the demographic of this training was predominantly early-career researchers. These were mostly junior research staff and PhD students meaning they were not decision-makers in their projects. As a result, their enthusiasm for CommCare did not easily translate into adoption by projects. The scaling benefits from this activity may not be fully felt for some time. For example, it is possible that future research projects adopt MAD technologies as these researchers advance in their careers and become project leads themselves. Certainly, the workshop was effective in spreading the learnings from the MAD pilot (presented in the workshop) to a wide range of projects (ten new projects were represented at the RAID workshop).

Intensive Training: fewer people at greater depth (The NARI training)

The AgImpact team delivered institutional-level training to PNG's National Agricultural Research Institute (NARI) as part of MAD 4 TADEP. As a format, these workshops had far fewer attendees than the RAID training, but allowed for greater depth of training to be provided. As a certified Dimagi partner, AgImpact negotiated to provide an ACIAR-tailored certification process for NARI. This process involved face to face learning by building agriculture-oriented sample applications complemented by some theory. This was concluded with a capstone exercise where the candidates could build an application of their own design with immediate application to their current assigned projects.

The NARI institutional training (held over two workshops) was aimed to enhance the CommCare capacity being developed through individual training to TADEP projects. The Family Teams, Canarium and Sweet Potato projects all expressed a strong desire that

training include members of their partner organisation, NARI. TADEP projects that did not have NARI as a partner organisation (Bougainville Cocoa and PNG Cocoa) also agreed that a resource pool of this nature would be valuable.

The training was delivered to five NARI staff members:

1. Jeromy Kavi, Junior Social Scientist
2. Elly Solomon, Juinior Livestock Scientist
3. Raywin Ovah, Junior Economist
4. Isidora Ramita, Junior Postharvest Scientist
5. Seniorl Anzu, Communications Officer

The first NARI training session was held over four days in November 2016. This workshop included introduction to CommCare and building individual apps (50% complete by the end of the training). The second training (also four days) was held in February 2017 and included revision of concepts before completing application building. Finally, the NARI staff were guided in how to train other staff in application use and monitoring data during collection.

This NARI training led to adoption of CommCare in two separate NARI projects (one funded by the European Union and another by the UN Development Programme). One NARI staff member trained in these workshops (Jeromy Kavi) successfully assisted the Family Teams project in their MAD implementation. NARI director Dr Sim Sar subsequently began internal discussions in the organisation about how to scale out MAD adoption in the institution and that the trainees were included in these discussions.

In contrast to the RAID training, the intensive training provided to IRRI and NARI staff resulted in much better adoption of MAD technologies in non-ACIAR projects. Both institutions embraced the technology and are now active champions of its use. Part of this success was due to the involvement of institutional management (as well as app builders) to ensure adoption decision makers are ‘in the room’ and understand the value of the technology and take advantage of their newfound capacity. The success of these institutional arrangements has since influenced the work in scaling MAD in Pakistan through the AVCCR program. The outcomes from these two efforts suggest that by targeting key research institutions and providing in-depth staff training, MAD technologies can be successfully scaled-out.

Scaling through programs (TADEP and AVCCR)

The MAD 4 TADEP SRA was an example of scaling MAD technology through a program uniting various projects with a single digital platform. This effort to scale MAD adoption through TADEP was hampered by the fact that the program had already commenced when the MAD 4 TADEP SRA was commissioned. Projects were mid-way through data collection and therefore apps were not easily implemented and were at times disruptive to project workflow. The success of MAD adoption in TADEP projects was mixed. Where it was more successful, this involved critical assistance from NARI staff involved in intensive institutional training. The primary outcome of this scaling method was that it allowed TADEP projects to connect and solve problems in a collective manner. While the TADEP program had limited success with MAD implementation, there are significant opportunities to use MAD technologies within programs to monitor activities between projects for reporting purposes. For example, MAD apps could be used to track all meetings within projects under a single umbrella program and report on women’s participation in project meetings.

The second program involved in the MAD series was the AVCCR in Pakistan. This program (in which Pakistan Dairy project sits) had more time to learn about MAD apps and adopt them. The program also had more time for management to understand the

value of the technology and projects were able to plan adoption prior to data collection. After exposure through the Pakistan Dairy project, a separate contract was developed between AgImpact and AVCCR to deliver CommCare training to ACIAR partners in country.

These experiences scaling through programs within the MAD series showed that adoption can be successful if starting early with the right people. In future, program scaling should focus on recording data of program activities that link to KPIs using MAD applications. Attention should be given to using MAD apps to harmonise data across program projects without sacrificing flexibility. A suggested approach would be to initially deliver a proof of concept on activity monitoring with just two projects within a program. The KPI-linked survey questions can be pulled out directly into a live dashboard for program managers in consultation with ACIAR.

Scaling through projects (Vietnam Vegetables)

A final approach for scaling-out MAD technologies was through projects that successfully adopt MAD becoming champions within their organisations. The Vietnam Vegetables project provides a good example of this. The project sits within the Centre for Global Food and Resources (GFAR) at the University of Adelaide. This project effectively acted as a pilot for GFAR, with lead Professor Wendy Umberger now a champion of MAD adoption. Professor Umberger had since begun implementing the technology in similar projects at the time of reporting (Figure 20). An ACIAR staff member who had worked on the MAD series was subsequently employed by Professor Umberger to work on an Indonesian Dairy project, and now consults closely on MAD activities with Pakistan Dairy lead Dr David McGill. This level of University of Adelaide staff and PhD students who were trained in application building can now build applications for other projects.

Scaling out results

The below network diagram illustrates the flow-on effects of the MAD series since it began in 2015. This demonstrates uptake by projects outside those directly funded and the linkages between them. Adoption refers to those projects that have committed resources to adoption by either buying tablets or committing staff time and have subsequently gone on to collect data using CommCare in the field.

Overall, this network indicates a fairly impressive spread of MAD adoption across a range of organisations in such a short amount of time. It demonstrates the potency and topical relevance of MAD technology in international agricultural research. On the map are nodes representing institutions and stand-alone research projects. IRRI and NARI are institutions, one a government organisation in Papua New Guinea and other an international research and training organisation headquartered in the Philippines with a broad SE Asian scope. Kopernik is an NGO as is the PNG country office of CARE that used CommCare for collecting data for their Women's Economic Empowerment metric.

As stated, several new research projects were introduced to CommCare through the Crawford Fund sponsored RAID workshop which is an Early Career Research (ECR) network. Several of the ACIAR pilot projects have trialled MAD technology and actively contributed to the wider diffusion of app-based data collection. Through the project leaders of the Bougainville Cocoa project, another research project in Indonesia with a similar focus took up the use of MAD apps. The Myanmar Dry Zone Project found out about apps from the project leader of the Pakistan Dairy project (based at the same faculty at the University of Melbourne). Following a brief introduction on how to set up a Project Space, a basic form and how to export data, Myanmar Dry Zone Project developed a survey gathering data on soils, fertilizers, crops and costs. They plan to expand on this for the rest of their project and are in the process of convincing other

project collaborators about the benefits. This adoption story, which is one of the many spill-overs from the pilots, was largely self-directed.

As exciting and transformative as ICT4D projects are globally, there is evidence to show that while they are seeded as pilots it is very hard to move the donor funded innovation beyond the pilot stage (Curioso & Mechael, 2010; Lemaire, 2011; McNamara, 2003). Therefore, the degree to which MAD technologies have spread in such a short time through the ACIAR SRAs is impressive, particularly in terms of institutional embedding and long-term adoption at scale.

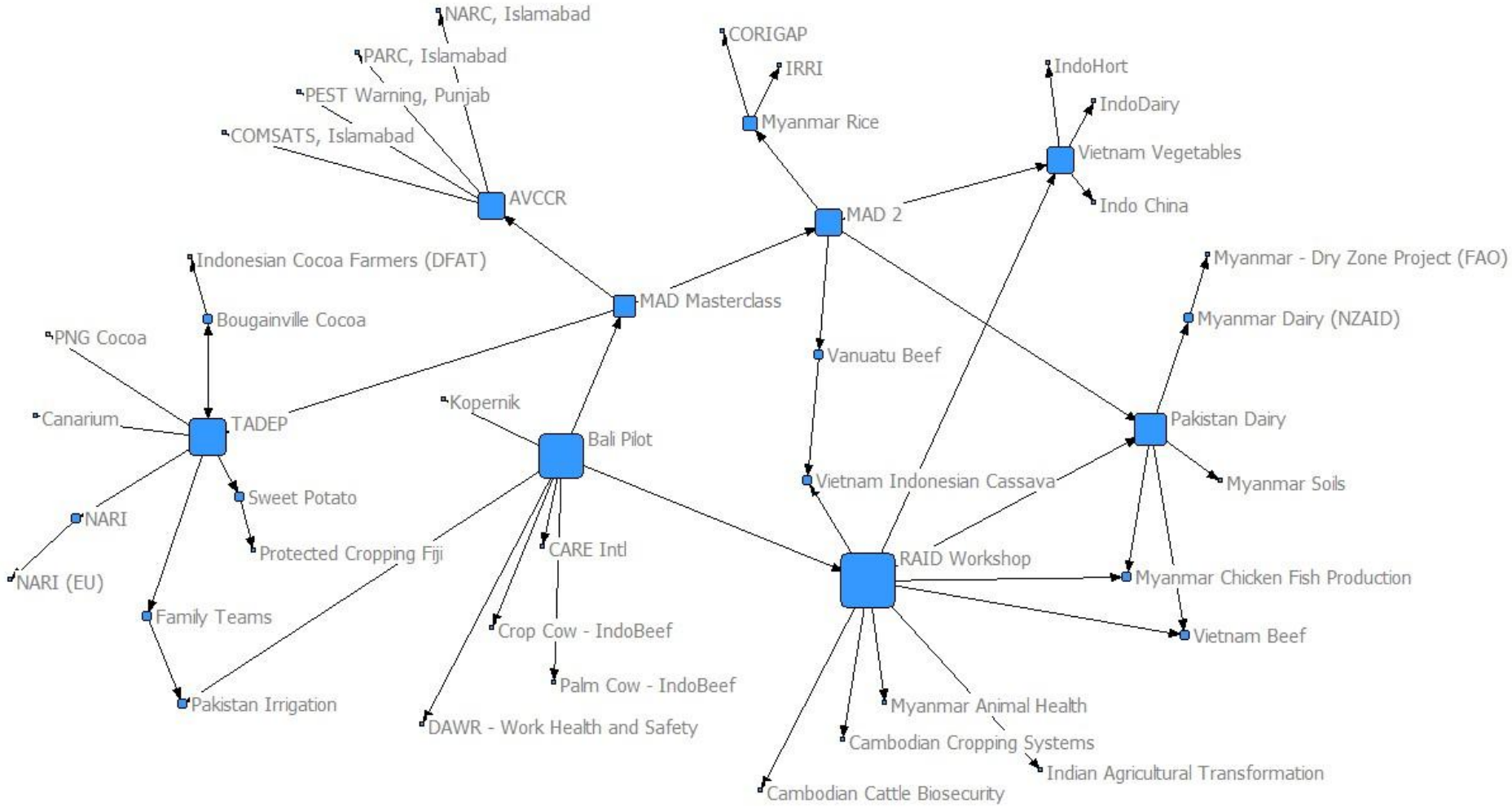

Figure 20: Network map of adoption of MAD technologies catalysed through the ACIAR MAD research series. Nodes are based on degree centrality.

7.3.5 A common platform for programs? (TADEP)

One of the key research questions in the MAD 4 TADEP SRA was concerned with identifying the advantages and disadvantages to programs that adopt and common MAD platform. Beyond benefits to individual projects (e.g. time saved in fieldwork) it was hypothesised that programs had separate additional benefits. For example, programs could aggregate data from multiple disparate projects to feed into better program management and reporting. However, the TADEP program did not realise these kinds of benefits during the MAD 4 TADEP SRA. This was due to two factors:

1. Logistics slowing individual project progress with MAD adoption
2. A mismatch between MAD adoption timeline and actual program/project timelines.

This meant there was insufficient time for the TADEP projects MAD capacity to mature to the level where programmatic benefits can be realised.

Logistics slowed down project progress

As seen in the TADEP case studies (Section 7.2) many projects struggled to make use of the allocated support available to them from AgImpact. In many cases remote support was unable to be used due to poor internet connectivity and lack of suitable devices. Furthermore, in some cases the training available was not delivered due to a lack of organisation within the project. Without this critical level of support, TADEP projects could not build capacity at the pace of MAD 2 projects which received much more face-to-face and remote support. Where TADEP projects were successful (e.g. Bougainville Cocoa and Family Teams), they received support from in-country partners (e.g. NARI) with MAD capacity developed separately through the SRA.

Mismatched timelines: MAD 4 SRA vs MAD 4 TADEP

Unlike in MAD 2, projects in the MAD 4 TADEP SRA had mostly begun data collection by the time the SRA had begun. This obviously made CommCare adoption more difficult to fully integrate into the project and program. The TADEP program itself failed to gain much of the potential benefits of adopting a common MAD platform because of this. Project and program timelines simply did not allow for the 'bigger picture' planning required to fully exploit CommCare. For example, CommCare could have allowed TADEP to have individual projects collect the same data in the same format that answered key program questions such as the degree of women's participation in the program. Individual projects could have asked the same question during otherwise completely different surveys that yielded the same data format, and TADEP program management could have accessed this data easily and as it was being collected. However, this would have required an agreed data collection strategy among program and project leaders to ensure the uniformity had properly accounted for project diversity, and that there was sufficient buy in. Such planning by necessity must come before fieldwork commences but this had already happened for most participating TADEP projects. Furthermore, such high-level planning is much more difficult outside of the dedicated program planning phase.

Length of MAD adoption: time taken to realise high-level benefits

Because of the slowed progress of the participating MAD 4 TADEP projects, they were unable to realise the high-level benefits of MAD technologies within the SRA period. Towards the end of the MAD 2 SRA, projects began to explore possibility of non-survey MAD activities. Examples include the feedback provided to farmers in Vanuatu Beef or the extension delivery in Pakistan Dairy. These MAD 2 projects also began to consider cross-linkages between their MAD field activities and work in other projects. For example, Professor Umberger (Vietnam Vegetales) began using MAD in non-SRA projects, while Dr

McGill (Pakistan Dairy) began dialogue with an Indonesian Dairy project also using CommCare. The ability of projects to begin to look ‘up and out’ beyond their own immediate MAD fieldwork needs (to begin exploring the other possibilities and opportunities) takes time to achieve. In MAD 2 these activities usually begin after successful deployment of MAD apps, once projects gained a sense of ease in their ability to use the technology for essential work.

In other words, the adoption process usually starts with a focus on immediate project needs (which appear easy then become more challenging during implementation). Only after those immediate needs have been met can projects turn their attention to other uses of the MAD platform. Figure 21 (below) provides a simplified schematic diagram used by AgImpact staff during app builder training. It outlines the MAD adoption process in terms of difficulty over time, along with a proposed distinction between an earlier stage (when only projects can benefit), and later stage (when programs can benefit). We argue that TADEP projects did not reach this second stage due to the logistical challenges and individual project and SRA timeline mismatch. TADEP projects did not reach the same point as MAD 2 projects mainly because (as stated earlier) they had less lead time available within existing project workloads and deadlines to contemplate and plan the use of CommCare. In addition, delivery of training and support was hampered for some projects by lack of internet connectivity and difficulty in finding time within existing workloads and schedules. The TADEP projects also did not participate in the MAD masterclass in June 2016, unlike MAD 2 projects. This Masterclass was important for getting buy in from project leaders, who could see the overarching benefits from MAD.

For these reasons, most TADEP projects would have completed the SRA somewhere between adoption stages 2 and 4. It is thanks to this hindered progress that program benefits were minimal. Ideas of how to use CommCare beyond immediate survey needs (e.g. for tracking meeting attendance, or providing participants with feedback) were not considered. Therefore, the program itself struggled to realise wider benefits of a common digital platform.

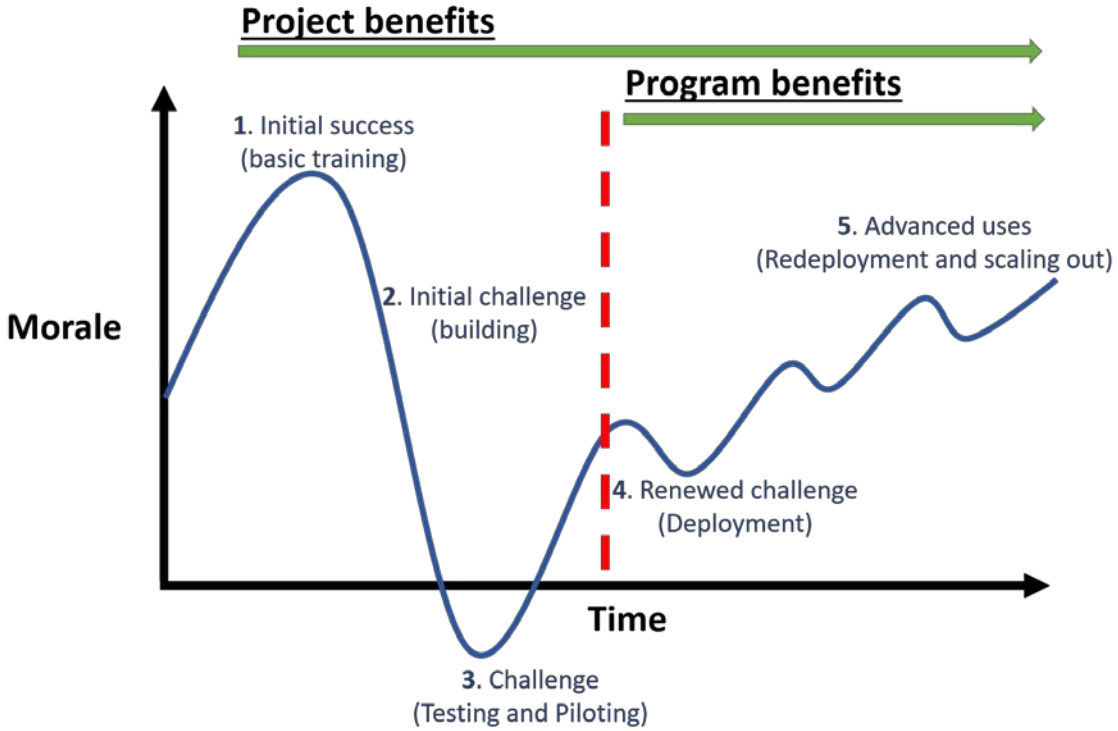

Figure 21: Schematic diagram of MAD adoption difficulty over time and where project and program benefits are realised. Initially based on experience of building individual MAD applications.

7.3.6 Technical, institutional & financial support needed

The case studies presented in sections 5 and 6 document a range of different project experiences in relation to support needs. While there were divergent experiences among the various MAD 2 and MAD 4 TADEP projects in level of support needed (and received), some general trends could be observed. Among the case studies, there were a number of reasons for successful MAD implementation. Projects could succeed due to:

- Staff enthusiasm (e.g. Canarium),
- Staff technical aptitude (e.g. Vietnam Vegetables),
- Project management support (e.g. Vanuatu Beef)
- Institutional support (e.g. MyRice)

If all of these factors exist in a single project, the potential for successful MAD implementation at scale is extremely high. MAD implementation also tended to fare better where field conditions favoured digital data collection over traditional paper-based systems (e.g. Bougainville Cocoa).

Technical support

Technical support typically formed the bulk of overall support needs for projects. The technical support time provided by AgImpact tended to be skewed towards days spent in face-to-face training (Sections 7.1 and 7.2). These sessions were largely used to rapidly build the technical capacity of the team in CommCare, with remote support for troubleshooting playing a much smaller role in overall support provision. When training was not the major support activity, this generally indicated a pre-existing technical capacity within the project, or logistical or institutional obstacles in delivering face-to-face training. As such, it would be reasonable to expect that as the agricultural research for development sector becomes more digitised (and technical capacity grows within organisations) much of the required technical support observed in these both SRAs will no longer be needed. In such a scenario, what becomes more important is the relevant institution's ability to maintain, support and exploit its own MAD capacity.

Institutional support

While the technical support was a critical foundation for MAD implementation, staff that had the greatest success also received strong support from their managers and institutions. In the first instance, capacity building was most successful when the staff selected for training were themselves enthusiastic about MAD activities. This was usually the case when management were engaged with the broader MAD agenda and took steps to properly consider which staff were most suited or best placed to quickly learn and implement MAD skills. The staff also tended to respond better when they were given a sense that institutional management would be responsive to their new skillset.

Institutional support was also critical in allowing the staff time for MAD activities. Staff needed permission to attend training or build their applications. Training could only take place when adequate venues and devices were provided, requiring logistical support from project management. In one case, the allotted second training for staff did not occur only because project management did not respond to requests from AgImpact to decide on training details. This exemplified the importance of institutional and managerial support in MAD implementation. Projects with management and institutions that are genuinely interested and engaged in MAD implementation will achieve great success where others will not.

Financial support needed

The financial investment needed to adopt MAD technologies covers the following essential items / activities:

- Devices (i.e. tablets)
- Research staff time (planning, training, building, testing, deployment, data monitoring)
- External support costs (training, remote support)
- CommCare subscription (usually only needed during data collection)

In the two SRAs described in this report, financial investments by projects did not cover the cost of MAD support provided by AgImpact – as this was paid for by ACIAR and outside of project budgets. In addition, Dimagi provided pro bono subscriptions for CommCare to the participating ACIAR projects during the SRA. As projects themselves were not paying for support or CommCare, the way in which these were used does not necessarily reflect how self-funded MAD adoption would operate.

With that in mind, the case study data can provide a guide for financial requirements when adopting MAD technology in a research project. The cost for devices, time, and external support will, of course, vary dramatically depending on the particular scale of the project and approach to adoption. Reference to individual case studies as a guide for particular contexts is encouraged.

Purchasing devices

All projects invested into the purchasing of mobile devices for data collection. Of those reporting costs accurately, the amount spent ranged from $2,200 (Pakistan Dairy) to $7,344 (Vietnam Vegetables). Based on the experience of the nine projects in these SRAs, it is highly recommended that devices being purchased are specifically tested for use in mobile data collection at the relevant site. Battery life is particularly important when testing devices. In some climates, rain covers are needed for devices attracting additional costs. The Bougainville Cocoa case study highlighted the need for spare devices to be available during fieldwork should any damage or losses occur. Finally, a lesson for care of devices is that (where appropriate) enumerators be provided the opportunity to purchase devices after fieldwork is completed. This can allow greater care to be taken of devices during the fieldwork and leaves an additional legacy of digital capacity among partner institutions.

Research staff time

The amount of project research staff time needed to adopt MAD technologies varied dramatically between case studies. This depended on the technical aptitude of staff (something intangible and not easily predicted), the approach to MAD adoption, and complexity of the applications being built. Actual time invested in MAD 2 case studies ranged from 56 days (MyRice) to 210 days (Pakistan Dairy). Pakistan Dairy had particularly high staff time allocated due to the implementation approach which involved a long, self-directed period of training and building but resulted in robust capacity development among the in-country partners. Among the TADEP projects, staff investment was much lower (ranging from 11 to 34 days) but their MAD activities tended to be narrower and less successful as a result. The standout performer among TADEP projects was Bougainville Cocoa, and this project also contributed the most staff time to MAD adoption (34 days).

External support

External support in these SRAs was largely provided by AgImpact, with all costs covered by ACIAR externally to individual project budgets. In many cases, the allocated support days were underutilised by projects, while for more enthusiastic projects additional days of

support were provided. The support time provided in MAD 2 projects ranged from 5 days (Pakistan Dairy) to 34 days (MyRice). Pakistan Dairy needed far less support due to its approach to MAD implementation, time available for training and development (much greater than other projects) and the previous CommCare experience of the project lead Dr McGill. Based on the other projects, it appeared that when building less complex and shorter instruments 15 days of support is sufficient providing app builders have underlying technical aptitude. More complex surveys (even with talented app builders) require more assistance and may range between 20-50 days. In MAD 4 TADEP, support days ranged from 5 days (Sweet Potato) to 23 days (Bougainville Cocoa). Once again, Bougainville Cocoa is highlighted among TADEP projects, having used more external support than any other.

CommCare subscriptions

At the time of reporting, a free subscription to CommCare provides access for an individual app builder to create surveys with basic functionality. This means most application development can occur without a paid subscription. To build more complex surveys (e.g. those using repeat groups, lookup tables) a subscription is required, but based on the SRA these can be built within the space of a month if priority is given to builders and targeted training is undertaken. Subscriptions are needed during fieldwork for multiple users to deploy a single application. However, given ACIAR project survey fieldwork usually occurs within a two-month period, in most cases paid subscriptions can be limited to three months with adequate planning. The actual cost of this depends on the level of subscription needed. Standard plans which would be sufficient for most uses cost $100 per month (i.e. $300 for 3 months), pro subscriptions cost $500 per month (i.e. $1500 for 3 months). At most, Advanced subscriptions cost $1000 per month.

8 Conclusions and recommendations

Examining the at-scale deployment trajectories of the nine ACIAR projects underscores the importance of training, organisational and contextual factors and a focus on data management for the successful adoption of MAD technologies. The two SRAs have shown variability in adoption experience, highlighting that future projects should look to similar projects (in scope, timelines and particular goals) to find contextually-sensitive examples. This is critical as projects will differ in their resources, available time for training, and existence/absence of a dedicated app manager.

8.1 What next?

8.1.1 More strategic adoption

Based on the MAD series results, ACIAR should consider facilitating more higher-level strategic workshops with management of partner organisations. MAD technologies have their greatest impact when institutional culture embraces them. However, ensuring holistic integration of digital data collection raises a range of possibly pathways forward for management and organisational policy. ACIAR's partners would benefit from assistance in both understanding the possibilities and planning for these changes at the higher level. For ACIAR, this will provide greater breadth when future projects seek to fully exploit the potential MAD technology. ACIAR should explore how such strategic workshops might be best tailored to their partners' needs and contexts. While it wasn't deemed suitable for ACIAR projects, there is a clear possibility that Dimagi's Maturity Model could be beneficial if applied to ACIAR partner organisations for this higher level strategic planning. Evaluating the model's efficacy through a pilot program is an obvious next step for ACIAR. Elements of the Dimagi Maturity Model may also prove useful should ACIAR transition to supporting fewer, larger, longer-term and more complex research programs or projects and these strategic workshops could also be deployed in such circunstances.

8.1.2 Reinforcing NARI support

The biggest success from the MAD 4 TADEP SRA came from its efforts to engage NARI with MAD technologies. Both the training of individual staff as app builders, and the engagement with NARI management led to genuine and sustainable capacity being developed with a key ACIAR partner. NARI has since deployed its newfound MAD capacity in other non-ACIAR projects, representing a significant successful outcome from ACIAR's support. However, NARI management have expressed interest in further developing its data policies around ICT and staff training was limited to only five individuals. Providing further staff training (e.g. in advanced CommCare concepts and more basic training for staff) would reinforce the success of MAD 4 TADEP. Further engagement with NARI management on what their internal goals for MAD adoption are and assisting their realisation would further cement the institutional ownership and capacity. This support for NARI may be the best way to support future ACIAR projects that have a genuine interest in using MAD during their research. The experience of the Family Teams project (working with NARI app builder Jeromy Kavi) demonstrates how projects can make use of partner institutional capacity. Subsequent work with AVCCR in Pakistan also supports this model as a suitable path forward for ACIAR's development of a MAD-culture in international agricultural research.

8.2 Final points

Below are some of the salient recommendations for projects, institutions and ACIAR that emerged from the projects.

To Project Leaders

1 **Allow for adequate preparation time**.
Consider the stage of the data collection plans before app building. The degree of communication and coordination between networked, multi stakeholder teams has as important an impact on app success as technical inputs.

2 **Use MAD adoption to improve research design**
The introduction of digital processes generates significant opportunities to change existing project design. Optimise these opportunities for organisational development by planning to get the most out of the process. As project members reiterated, 'CommCare is a great tool, it depends how you use it' and when there are no clear targets, app building takes longer.

3 Proper testing at a site that represents conditions of actual fieldwork is essential
This can allow early detection of app design flaws or logistical issues (e.g. internet connectivity). Ensuring proper piloting will save time and money during critical fieldwork when there are greater consequences from delays and data loss.

4 Generate feedback loops to allow better data accuracy
MAD technologies can allow comments on data accuracy to be fed back to the frontline workers during fieldwork. Several projects in this evaluation as well as global CommCare deployment case studies have emphasised the conscious effort required to make use of the systems' full capacity beyond one-way communication – it is necessary to 'close the feedback loop' (DeRenzi et al., 2016) in the design and deployment of digital technologies. Otherwise, at best it produces efficiency gains for project administrators and no genuine grassroots level engagement.

5 In some contexts, enumerators will require digital literacy training.
The novelty of digital systems meant some projects spent much of the training focused on running the app. It is important not to neglect broader training for in-country enumerator staff.

6 Apps are not a silver bullet or a solution to every problem
Data collection using in depth interviews and participatory qualitative methodologies (such as those that reflect Pacific narrative traditions) do not translate well into CommCare.

7 Local Champions are important
Projects should avoid assuming that a mobile tech solution is user friendly and a fix for all needs. Projects need to engage with the idea of MAD, temper 'tech optimism' and start with a realistic long-term approach while investing in local partnerships.

8 Build communities of practice within organisations while introducing app building skills.
As much as possible, draw on existing collaborative networks to support learning. This is especially helpful when app building is seen as challenging, and has proven extremely successful in a number of MAD series projects.

To projects with organisational/institutional partnerships

1 When projects are collaborating with organisations to carry out the research, tailor training to suit existing workflows.

A Dimagi-authored review (Bhavsar & Grijalva, 2013) recommends that the organisation be encouraged to 'map the activities of all relevant stakeholders and the flow of information between them' right at the design phase because 'workflow practiced in the field may be different from the expected behaviour assumed by decision makers supporting programs remotely'.

2 Successful adoption of the technology will require 'training' of all levels of management.

Training of management ensures more junior staff with app building skills are suitably resourced and supported by the organisation. It is also crucial to ensure that key members of staff at the middle management and operations level are not unavailable at critical milestones during the roll out of the project. Every effort needs to be made to ensure that the digital pilot does not function as a silo or an isolated module within an organisation. Full capacity of the technology can only be tapped into when there is a broader understanding of institutional culture and organisational barriers to successful deployment.

3 Selecting the right staff members to become app builders is critical to the success of MAD implementation.

Projects should work with partner institutions to guide selection of staff based on genuine individual enthusiasm and intuitive technical capacity. Institutions need to be supportive of those receiving training, and develop plans to make use of their newly-developed skillsets.

4 It is important to plan for adequate lead-in time to the project so that training needs can be met.

This is particularly important when dealing with enumerators and frontline staff in remote locations with little prior experience in mobile phone use. In the case of the TADEP context, it would be ideal to plan towards a stage where there are skilled people within PNG who are able to apply lessons learnt from one project to another, helping with troubleshooting and technical support. To this end, the PNG Cocoa team recommended that someone in the CCI (Cocoa and Coconut Institute) be trained to that level of technical competence for their midline and endline surveys; so that they can then go out and train others in the provinces.

5 It is important to plan for 'going digital' and factor in MAD apps from the start.

Retrofitting a project after budget allocations have been made and research activities have commenced generates a unique set of challenges. Without a well-defined scope and a needs assessment at the onset, many other important project activities could be sidelined because of the attention demanded by MAD adoption.

To ACIAR

1. Some projects are extremely well-placed to realise the benefits of adopting MAD technologies, while others are less suited.

The MAD series has shown that benefits are most likely when i) a partner institution has genuine enthusiasm for the technology, ii) when project leads are supportive, iii) when staff are given adequate time and support to build capacity before deployment, iv) when surveys are longer and complex, v) when scale of operations increase benefits from time saving; and vi) when data monitoring and rapid feedback are incorporated into the study. ACIAR should use these criteria to help identify MAD-friendly projects in the early

proposal stage, and encourage project leads to consider MAD adoption within the design and timeline.

2. **In-person Masterclasses are important to achieve buy-in from project leaders.**

Project leaders can initially be sceptical of the value of MAD apps in their research. The value in having multiple projects come together in person and discuss the potential value and concerns with MAD is the most effective way to overcome this scepticism and achieve true buy-in. While the MAD 2 project leads and app builders had this opportunity, the TADEP projects did not. This exposure to Masterclass materials without the in-person element did not achieve the same level of support and enthusiasm for MAD adoption. For future scaling efforts, ACIAR should place a premium on project lead attendance at face-to-face Masterclasses or try and incorporate an element of MAD exposure at gatherings of project leaders within a program or country.

3. **ACIAR should explore other MAD potential beyond "survey" work.**

In particular, MAD could be used for day to day project management (e.g. buying records in Canarium, faecal collection and project enquiries in Vanuatu Beef, etc) and for centralising project-related records. These project records could also relate back to key performance indicators (KPIs) such as work women's participation in projects. Few of the MAD series projects explored this potential due to a focus on MAD as a survey tool.

4. **Adoption of MAD technologies can transform the value of ACIAR-supported research.**

The value of ACIAR-supported research can be radically improved through MAD. This potential is perhaps greatest if projects develop and apply rapid feedback mechanisms and embedded extension materials into fieldwork using MAD technologies. The benefit of fostering MAD adoption within the ACIAR-network will be more receptive countries, institutions and communities where ACIAR works, leading to improving relations with Australia's neighbours.

5. **ACIAR can lead other donors' in using MAD for international agricultural research.**

By encouraging adoption of MAD technologies for international agricultural research, ACIAR can build capacity in partner countries that spills-over into other programs and projects. These may include locally-managed programs (e.g. in the case of Canarium or Sweet Potato) or those involving other international partners (e.g. IRRI with MyRice). By being a 'first MAD actor' in target communities and institutions, ACIAR is influencing how MAD technology is used in international agricultural research, and paving the way for improved projects with other donors.

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9.2 List of publications produced by project

None

10 Appendices

10.1 Appendix 1: Photo/story tips and video links

10.1.1 MAD Top Tips: Video & Photography

Capturing stories from the field is an invaluable part of research and project reporting. Photography and videography performed well adds a richness to the data. There are a number of technical aspects that can be easily adopted to make every photo or video taken in the field count.

https://www.youtube.com/watch?v=rDzuk7p7HVI

10.1.2 MAD Top Tips: Data Management

With the introduction of apps, creating, modifying, deploying and analysing surveys is faster compared to the traditional paper based approach. What might researchers consider doing differently now they are saving time spent on surveying in the field and are receiving data in near real time?

https://www.youtube.com/watch?v=sFiyJ6AOGK8

10.1.3 MAD Top Tips: Security and Informed Consent

In Australia, human research is defined as “research conducted with or about people, or their data or tissue.” Thus, even a basic survey asking people about agricultural practices is considered human research. Before researchers commence data collection for research it is best practice to obtain approval from a human ethics committee, both in Australia as well as in the project country. Ethics committees are interested in understanding the security of the data collected; if it was provided under informed consent; and how might adverse events be reported. The introduction of apps changes the way these questions are addressed.

https://www.youtube.com/watch?v=q3YqnPGE7qI

10.1.4 Jeromy Kavi film (NARI PNG)

In early 2017 Jeromy Kavi and others from the National Agricultural Research Institute (NARI) in Papua New Guinea received training in digital data collection - building mobile apps to collect data for their research - as part of an initiative by ACIAR (Australian Centre for International Agricultural Research).

https://www.youtube.com/watch?v=TP9Fu2eNhkQ

10.1.5 Extended Vanuatu Beef project

AgImpact follows the Vanuatu Beef, Bisnis Blong Buluk project led by Dr Simon Quigley as they use mobile app CommCare in Vanuatu to conduct research and share information with farmers for the first time.

https://www.youtube.com/watch?v=Q_JD_a38mcc

10.1.6 MAD 4 TADEP lessons learned

A summary of lessons learned during ACIAR's MAD4TADEP project

https://www.youtube.com/watch?v=E-BpaQdaREg

10.1.7 ACIAR MAD research series summary

Wrapping up ACIAR's Mobile Acquired Data research series with outcomes and perceptions.

https://www.youtube.com/watch?v=kHZJ5u6WuC4

10.2 Appendix 2: Dimagi Maturity Model assessments (MAD 2)

10.2.1 Vietnam Vegetables

Three project staff (Christian Genova, Suzie Newman and Alexandra Peralta) completed the Maturity Model questionnaire at the beginning of the SRA. The results showed staff ranked the project at different levels of maturity and had differing targets for the end of the SRA. Christian Genova denoted his part of the Vietnam Vegetables project (i.e. his PhD study) at Stage 1 in each area and had a target of reaching Stage 2 by the end of the 12-month period (Table 6). Suzie Newman ranked the project at a higher maturity score, particularly with regards to program design and data-driven management. He mostly aimed to improve the 'Technical Support', 'Scale', and 'Sustainability and Strategic Alignment' of the project. Alexandra Peralta aimed for the project to fully develop its program design capacity in the 12 months (i.e. from Stage 1 to 5), and wanted moderate improvements (i.e. up two stages) in most areas (Table 6). Both Suzie Newman and Alexandra Peralta aimed to have their staff training and implementation polices for mobile tech used in practice (Stage 3) by the end of the SRA, and wanted the scale of apps to be fully deployed with target users (Stage 3).

All staff ranked program design as the number one priority for capacity building, and Christian and Suzie ranked data management, and technical support as priorities two and three respectively. On the other hand, Alexandra Peralta placed a higher priority on training and implementation, placing it as the second priority after program design (Table 6). Staff confidence in progressing on their own also varied, with Alexandra Peralta being more somewhat confident in self-direction and Christian and Suzie ranging between neutral and confident depending on the area.

Table 24: Overall CommCare maturity score (current and target) based on Dimagi's Maturity Model questionnaire. Questionnaires completed by Vietnam Vegetables project staff at the beginning of the SRA. See Section 7.1 for a matrix explaining each maturity stage per area.

Area	Staff member	Current score	Target in 12 months	Priority	Confident to mature on own?
Overall score	Christian Genova	0.0	1.1	-	-
	Suzie Newman	2.2	2.8	-	-
	Alexandra Peralta	1.3	3.5	-	-
Program design	Christian Genova	0.0	1.0	1	Neutral
	Suzie Newman	3.0	4.0	1	Neutral
	Alexandra Peralta	1.0	5.0	1	Somewhat confident
Data driven management	Christian Genova	0.0	1.0	2	Confident
	Suzie Newman	4.5	4.5	2	Confident
	Alexandra Peralta	2.0	2.5	3	Somewhat confident
Technical support	Christian Genova	0.0	1.0	3	Somewhat confident
	Suzie Newman	1.5	3.0	3	Neutral
	Alexandra Peralta	1.5	3.5	4	Somewhat confident
Training and implementation	Christian Genova	0.0	1.0	4	Somewhat confident
	Suzie Newman	2.0	3.0	4	Confident
	Alexandra Peralta	1.0	3.0	2	Somewhat confident
Scale	Christian Genova	0.0	1.0	5	Somewhat confident
	Suzie Newman	1.3	1.0	5	Neutral
	Alexandra Peralta	1.0	3.5	5	Somewhat confident
Sustainability and strategic management	Christian Genova	0.0	1.0	6	Somewhat confident
	Suzie Newman	1.0	1.0	6	Neutral
	Alexandra Peralta	1.0	3.5	6	Somewhat confident

10.2.2 Pakistan Dairy

The two project leads Dr David McGill and Dr Hassan Warriach completed the Maturity Model questionnaire at the commencement of the SRA. Results showed that Dr McGill had a much higher target overall, reflecting a high target for 'Program Design', 'Data Driven Management' and 'Technical support' (Table 10). Both project leaders aimed for only to reach a scale of 'adoption among frontline workers' (Stage 2) and sustainability of 'building awareness, buy in and support of the program' (Stage 3). Both ranked Program design as the top priority for capacity development, with technical support coming in second (Table 10). The two leads were confident in data management, technical support and training.

Table 25: Overall CommCare maturity score (current and target) based on Dimagi's Maturity Model questionnaire. Questionnaires completed by Pakistan Dairy project staff at the beginning of the SRA. See Section 7.1 for a matrix explaining each maturity stage per area.

Area	Staff member	Current score	Target in 12 months	Priority	Confident to mature on own?
Overall score	David McGill	1.9	3.4	-	-
	Hassan Warriach	1.1	1.9	-	-
Program design	David McGill	1.0	4.0	1	Confident
	Hassan Warriach	1.0	1.0	1	Neutral
Data driven management	David McGill	3.0	4.5	3	Very confident
	Hassan Warriach	1.0	1.5	4	Very confident
Technical support	David McGill	2.0	4.0	2	Confident
	Hassan Warriach	1.0	2.5	2	Very confident
Training and implementation	David McGill	2.0	3.5	4	Confident
	Hassan Warriach	1.0	2.0	3	Very confident
Scale	David McGill	1.3	2.0	6	Neutral
	Hassan Warriach	1.3	2.5	5	Neutral
Sustainability and strategic management	David McGill	2.0	2.5	5	Neutral
	Hassan Warriach	1.5	2.0	6	Somewhat confident

10.2.3 Vanuatu Beef

The project leads Dr Simon Quigley and Dr Cherise Addinsall both completed the Maturity Model questionnaire at the commencement of the SRA. Responses showed the project had moderate aims overall (i.e. to reach Stages 2-3) but the two respondents differed in the particular area goals (Table 14). Program design was given the top priority from both respondents, with Simon Quigley aiming to 'validated content used by frontline workers' (Stage 3) and Dr Addinsall aiming to have 'additional use cases added to technology platform' (Stage 5). Conversely, Dr Quigley wanted data driven management to advance to being 'used to improve program design' (Stage 5) while Dr Addinsall wanted it to be 'periodically used for performance improvement or evaluation' (Stage 3). The two both wanted project 'technical resources certified and regularly conducting basic support' (Stage 3). Another area of differentiation was the aimed scale: Dr Addinsall wanted 'all processes documented and expanding to additional uses' (Stage 4) while Dr Quigley aimed only for 'increasing adoption with frontline workers' (Stage 2). Both researchers were confident in 'Data driven management', 'Scale', and 'Sustainability and strategic management', but Dr Quigley was less confident in 'Program design', 'Technical support', and 'Training and implementation' (Table 14).

Table 26: Overall CommCare maturity score (current and target) based on Dimagi's Maturity Model questionnaire. Questionnaires completed by Vanuatu Beef project staff at the beginning of the SRA. See Section 7.1 for a matrix explaining each maturity stage per area.

Area	Staff member	Current score	Target in 12 months	Priority	Confident to mature on own?
Overall score	Simon Quigley	1.5	2.8	-	-
	Cherise Addinsall	1.2	3.3	-	-
Program design	Simon Quigley	2.0	3.0	1	Not confident
	Cherise Addinsall	1.0	5.0	1	Very confident
Data driven management	Simon Quigley	3.0	5.0	3	Confident
	Cherise Addinsall	1.5	3.0	3	Very confident
Technical support	Simon Quigley	1.0	3.0	4	Not confident
	Cherise Addinsall	1.0	3.0	2	Confident
Training and implementation	Simon Quigley	1.0	2.0	2	Not confident
	Cherise Addinsall	1.5	3.5	4	Confident
Scale	Simon Quigley	1.0	1.5	5	Confident
	Cherise Addinsall	1.0	4.0	5	Confident
Sustainability and strategic management	Simon Quigley	1.0	2.5	6	Confident
	Cherise Addinsall	1.0	1.5	6	Confident

10.2.4 MyRice

The Maturity Model questionnaire was jointly completed on behalf of the MyRice project by research staff members Su Su and Nyo Me (Table 18). Data driven management was ranked as the number one priority area for the project, with the aim being to progress from data being 'periodically used for performance improvement' (Stage 3) to 'being used to improve program design' (Stage 5). Unusually, the two respondents ranked 'Technical support', 'training and implementation' and 'Scale' areas as equally second in priority for project CommCare capacity development (Table 18). Technical support was aimed to go from 'limited' (Stage 1) to 'fully capable, but still needing limited external support' (Stage 4). Training and implementation was slated to progress from relevant policies 'not yet modified from mobile tech' (Stage 1) to 'adapted' (Stage 2). Scale of CommCare implementation was targeted to be 'fully deployed with specific target users' (Stage 3). The project was listed as 'not confident' in self-directed progress of all areas (Table 18).

Table 27: Overall CommCare maturity score (current and target) based on Dimagi's Maturity Model questionnaire. Questionnaires completed by MyRice project staff at the beginning of the SRA. See Section 7.1 for a matrix explaining each maturity stage per area.

Area	Staff member	Current score	Target in 12 months	Priority	Confident to mature on own?
Overall score	Su Su and Nyo Me	1.5	2.8	-	-
Program design	Su Su and Nyo Me	1.0	0.0	5	Not confident
Data driven management	Su Su and Nyo Me	3.0	5.0	1	Not confident
Technical support	Su Su and Nyo Me	1.0	4.0	2	Not confident
Training and implementation	Su Su and Nyo Me	1.0	2.0	2	Not confident
Scale	Su Su and Nyo Me	1.0	3.0	2	Not confident
Sustainability and strategic management	Su Su and Nyo Me	2.0	2.5	3	Not confident

10.3 Appendix 3: AgImpact guide to successful CommCare Implementation

Stage	Activity	Purpose
1. Assess Need	If implementation has already begun prior to engagement us Maturity model to assess project stage.	Determine what phase of implementation the project is currently in & beneficial support engagements
	Introduction to CommCare & case studies review	Give stakeholders an overview of CommCare & how it can be used
	Minimum requirements feasibility discussion	Determine if the project can meet the minimum requirements for human and technical resources to implement a CommCare application, whether internally or by engaging third parties
	CommCare value assessment	Have stakeholders self-assess the level of value they believe CommCare can add to their project & decide whether to proceed
	Scoping interview	For SRA, collect data about expectations for CommCare
	Define support engagements	Determine activities for which the project requires AgImpact support & what level of support will be provided
	Collect background information	AgImpact collects all relevant project documentation & contacts prior to support engagement
Stage	**Activity**	**Purpose**
2. Plan	Project KPI & data analysis brainstorming session	Brainstorm ideal data analysis & SOP outputs that meet project KPIs. Prepare stakeholders to reverse engineer their application requirements

	Identify a data analysis tool	Determine what product will be used for data analysis
	High level functional specification (scope)	Develop a document that defines high level project specific goals for the application & potential expansion phases (refining the brainstorming outputs)
	Needs analysis	Determine the human & technical resources required to implement the functional specification & how the project will meet these needs
	Prepare a project timeline	Have all stakeholders understand the necessary time commitments - who will be responsible for what & when
Stage	**Activity**	**Purpose**
3. Train & Build	CommCare fundamentals course & testing	Ensure a minimum number of people have an understanding of how CommCare works at a fundamental level
	Application building masterclass & testing	Ensure a minimum number of people have the essential skills to build and maintain a CommCare application
	Create specification for prototype app & invite feedback from primary stakeholders	Outline application architecture in a familiar format that is easy to provide feedback on. Excel or paper format
	Develop the prototype application	Create a deployable CommCare application that is ready for testing. Iterative improvement will be continuous based on feedback from reviews as well as internal and user testing
	Architecture & best practices review	Assess the specification to ensure the architecture is logically sound & that best practices have been followed
Stage	**Activity**	**Purpose**
	Prepare a test plan	Outline the use cases and steps for repeatable testing of every aspect of the application

4. Test & Deploy	Internal testing using the test plan	Catch bugs in application logic, issues with translation or practical problems that are immediately apparent
	Complete field testing and deployment checklist	Ensure the project is fully prepared for deployment & has completed a checklist covering resources, logistics & communications
	Mobile worker baseline assessment	Assess the familiarity of users with mobile technologies & their expectations for the pilot
	Mobile worker training & testing	Ensure users have the necessary skills to use the application in the field
	Create a mobile device usage agreement & monitoring plan	Know where devices have been assigned and how they are being used and communicate that policy to mobile workers
	Deployment	Use the application to collect data in the field
	Enumerator Daily Diary	Have mobile workers complete a short daily survey to capture their experiences in the field
	Observation visit	Observe & assess the design & use of the application in the field

10.4 Appendix 4: MAD Showcase report

10.4.1 Program

In August, 2017 AgImpact held a MAD Masterclass the day following the annual Crawford Conference in Canberra, Australia. Table 28 below provides an abridged outline of the day's program. The Showcase consisted of a series of short presentations (i.e. 10-30 minutes) providing summaries of various MAD adoption topics and project experiences. These were followed by three panel discussions featuring partner institution managers, project leaders, and app builders from the MAD SRA series. Panels were interactive, with participants encouraged to submit questions using an online platform 'Slido' (sli.do). The afternoon featured a session where the audience were presented with a range of presentations to choose from and voted for their preferred topic. The day closed with a high-level panel featuring ACIAR CEO Andrew Campbell, AgImpact CEO Stuart Higgins and Dimagi executive Anthony Connor. Attendees were encouraged to tweet during the sessions, with tweets being shared on screen throughout the day.

Table 28: Abridged program of MAD Showcase presented in Canberra, August 2017.

Time	Session	Topic
8:30 – 10:30	Registration Overview MAD process (presentation) Top 4 app data issues Top 4 app management issues	Introduction to the MAD SRA series, Top tips from AgImpact support staff
10:30 – 11:30	**Panel 1:** Apps for programs and partners	Do MAD apps bring value to programs and partners? Institutional-level concerns and lessons
11:30 - 12:30	**Panel 2:** Project leader perspectives	Do MAD apps bring value to projects? Issues at the project-level
13:30 – 15:00	**Panel 3:** App managers perspectives	Do MAD apps bring value to projects? Lessons from designing surveys and collecting data
15:30 – 16:30	**Audience decides:** series of short presentations offered, half of these were presented based on audience polling	Effects of MAD adoption in various areas, e.g. - Women's empowerment - Extension provision - Relationships w participants - Organisation culture

16:30 – 17:30	**Panel 4:** ACIAR and apps (where to from here?)	What is the future of MAD apps for international agricultural research?

10.4.2 Engagement and learning

Attendees included policy representatives from DFAT, ACIAR staff and project leaders, university researchers, early career researchers and Crawford scholars. Fifty-six attendees registered for the day. Sixty three percent of these attendees had heard of MAD apps but had never used them (Figure 22). Fourteen percent had started using MAD apps and thirteen percent had implemented MAD technologies in their project or organisation (Figure 22).

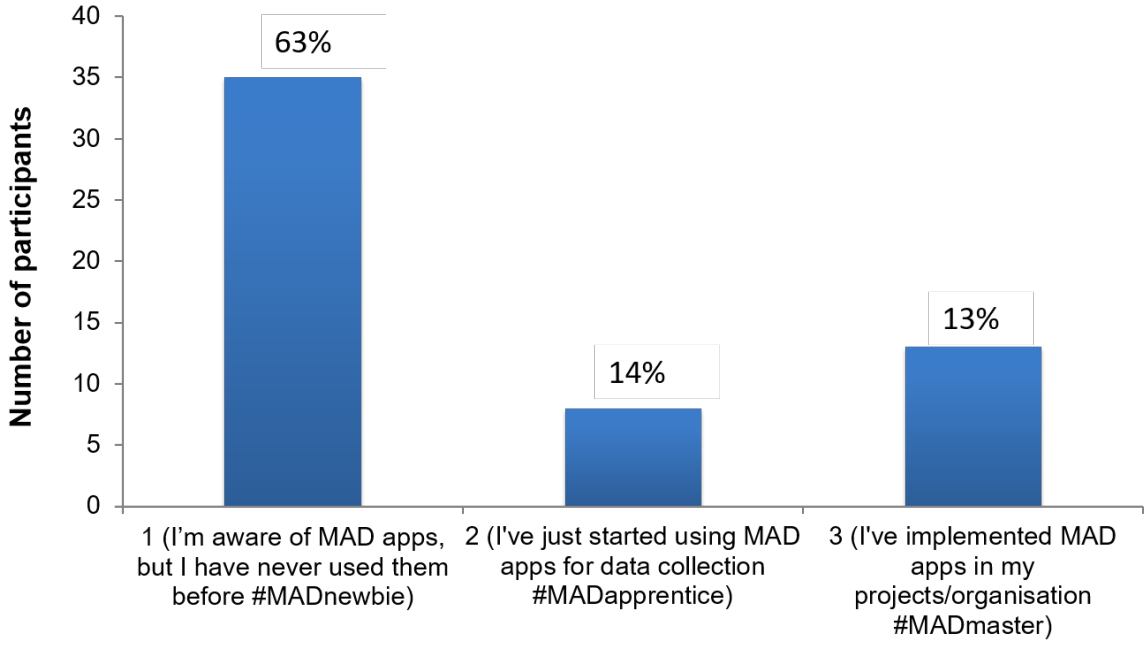

Figure 22: Prior knowledge of MAD apps among registered attendees of the MAD showcase in August 2017.

Seventy people logged on to the dedicated 'Slido' page during the Showcase, and 81 questions were submitted. Forty-eight of these questions were approved by moderators. Thirty-eight people voted in polls selecting which topics were covered in the day's presentations. Attendees of the Showcase were asked for feedback after the event on how enthusiastic they were for MAD technologies. The feedback survey received 29 responses, with 27 saying they were either 'extremely enthusiastic' or 'very enthusiastic' (Figure 23).

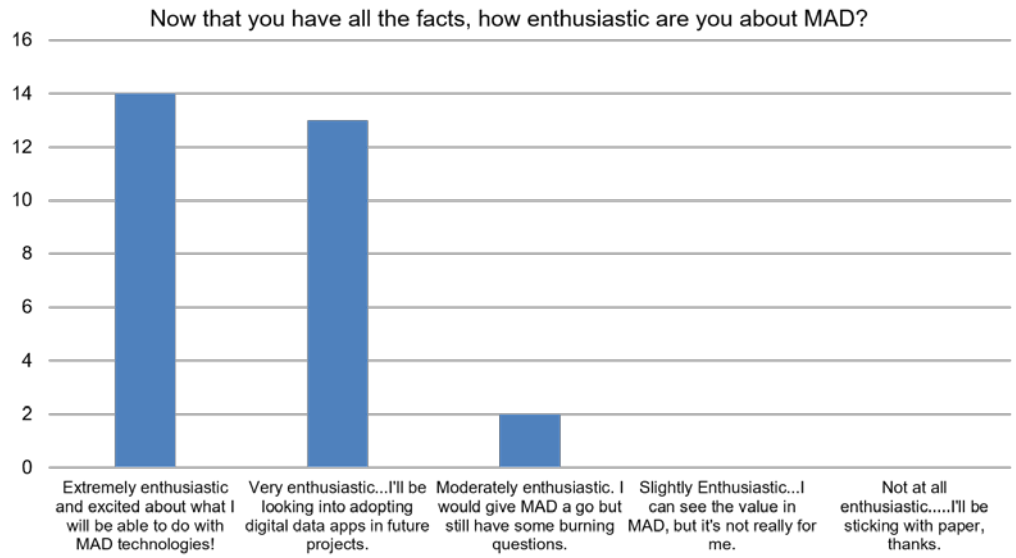

Figure 23: Feedback from Showcase attendees after the event on their enthusiasm for MAD technologies.