

## Final Component Report

Component/ Expected Project Result:	<b>Livestock Component</b> <i>Result: Livestock and fish production diversification options resilient precipitation deficits and/or deficits or soil salinity, and reliant on cost-effective locally produced feed/forages available to smallholder communities in PNG, Solomon Islands and Vanuatu</i>
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### 1. Achievement of the output and milestones in the component including what was not achieved and why?

The description of the achievements for all outputs and corresponding milestones is done by project sites.

#### (i) TAMBUL SITES

Two main sites (Kiripia and Alkena) in the Mt. Giluwe Rural LLG of Tambul/Nebilyer electorate in Western Highlands Province which represented some 15 percent of PNG population that inhabit the high altitude highlands areas below 2000 masl were initially selected on its affinities on its excessive soil moisture condition. These two sites are reportedly to have experienced consistent climate change associated risks such as frost, drought and excessive soil moisture conditions. Sweet potato cultivation for food and feed together with pig farming which play an important role in the livelihood of most people living in these areas continue to plunge as a result.

After diligent community consultation activities, the effective utilization of sweet potato for livestock (pig and poultry including fish) feed was voted by the communities as important in mitigating climate change associated risks. Two major objectives planned out based on rigorous community consultation include **Objective 5: increased capacity of interested farmers for using improved pig and chicken feeding practices based on sweet potato** and **Objective 6: Increased capacity for using integrated livestock farming practices for inland fish and duck production by selected farmers in Tambul communities**. Two interventions identified to address objective 5 are – (i) improved management and feeding of local pigs based on effective utilization of sweet potato as silage feed for grower pigs, and (ii) improved management and feeding of broiler chickens and or layer birds (village chickens) based on sweet potato. The integrated livestock farming practice on the other hand involve the introduction of GIFT tilapia fish which is the most preferred and emerging fish cultured species in the region because of its fast growth rate and high tolerance to different climatic conditions. Unlike fish monoculture where most people are familiar with the Integration of fish with duck is a new concept that can provide diversified options for the farmers.

TAMBUL SITES				
<i>Output 5: Increased capacity of interested farmers in Tambul community for using improved pig and chicken feeding practices based on sweet potato</i>				
<b>a) Improved management and feeding practices for local pigs based on sweet potato</b>				
	Milestones	Expected date of achievement	Achievement (%) at reporting period	Actual date of achievement
M1	Interested farmers & suitable sites identified in both sites for livestock interventions (layer, broiler, pig) & baseline established	Mar 2013 Dec 2014 Sep 2015	Round 1 – 100% Round 2 – 100% Round 3 – 100%	Jun-13 Mar-14 Dec-14

M2	Selected model interested farmers trained on husbandry practices, feeding systems, housing, health & disease management & control	Jun-13	Round 1 – 100% Round 2 – 100% Round 3 – 100%	Jun-13 Mar-14 Dec-14
M3	Selected model made set up essential farm structures and acquired materials (eg. wires, timber, drinkers, feeders, feeds, nails, etc) with assistance from the project to demonstrate improved practices	Jun-13	Round 1 – 100% Round 2 – 100% Round 3 – 100%	Jun-13 Mar-14 Mar-15
M4	Suitable breeding stocks (layer and broiler chickens, pigs) acquired and established in the farms of participating farmers	Jun 2013 Mar 2014 Dec 2015	Round 1 – 100% Round 2 – 100% Round 3 – 100%	Jun-13 Mar-14 Mar-15
M5	On-farm demonstrations and evaluations of introduced livestock interventions (layer, broiler chicken & pigs) conducted and documented	Dec 2013 Jun 2014 Mar 2015	Round 1 – 100% Round 2 – 100% Round 3 – 100%	Dec-13 Jul-14 Mar-15
M6	Participatory assessments of, and reflections on, introduced technologies conducted and documented and next steps drawn up	Dec 2013 Jun 2014 Mar 2015	Round 1 – 100% Round 2 – 100% Round 3 – 100%	Jan-14 Sep-14 Dec-15
<b>b) Improved management and feeding practices for broiler and crossbred layer chickens based on sweet potato</b>				
M1	Interested farmers & suitable sites identified in both sites for livestock interventions (layer, broiler) & baseline established	Mar 2013 Dec 2014 Sep 2015	Round 1 – 100% Round 2 – 100% Round 3 -100%	Mar-13 May-15 Jun-15
M2	Selected model interested farmers trained on husbandry practices, feeding systems, housing, health & disease management & control	Jun-13	Round 1 – 100% Round 2 – 100% Round 3 -100%	Mar-13 May-15 Jun-15
M3	Selected model made set up essential farm structures and acquired materials (eg. wires, timber, drinkers, feeders, feeds, nails, etc) with assistance from the project to demonstrate improved practices	Jun-13	Round 1 – 100% Round 2 – 100% Round 3 -100%	Mar-13 May-15 Jun-15
M4	Suitable breeding stocks (layer and broiler chickens) acquired and established in the farms of participating farmers	Jun 2013 Mar 2014 Dec 2015	Round 1 – 100% Round 2 – 100% Round 3 -100%	Mar-13 May-15 Jun-15
M5	On-farm demonstrations and evaluations of introduced livestock interventions (layer, broiler chicken) conducted and documented	Dec 2013 Jun 2014 Dec 2015	Round 1 – 100% Round 2 – 100% Round 3 -100%	May-13 Jun-15 Sept-15

M6	Participatory assessments of, and reflections on, introduced technologies conducted and documented and next steps drawn up	Dec 2013 Jun 2014 Dec 2015	Round 1 – 100% Round 2 – 100% Round 3 -100%	Jun-13 Jun-15 Nov-15
<b>Output 6: Increased capacity for using integrated livestock farming practices for inland fish and duck production by selected farmers in Tambul community</b>				
M1	Interested farmers and suitable sites for integrated poultry-fish pond units identified and established	Mar 2013 Dec 2014 Sep 2015	R1-100% R2-100% R3-100%	Mar-13 May-15 Jun-15
M2	Selected model farmers provided with hands-on training in the set up and operation of integrated pond units	Jun-13	R1-100% R2-100% R3-100%	Mar-13 May-15 Jun-15
M3	Integrated farm units (pond, shed, structures) constructed and made operational	Jun-13	R1-100% R2-100% R3-100%	Mar-13 May-15 Jun-15
M4	Suitable stocks (fish, duck) acquired and established by the participating model farmers	Jun 2013 Mar 2014 Dec 2015	R1-100% R2-100% R3-100%	Mar-13 May-15 Jun-15
M5	On-farm demonstrations and evaluations of introduced fish-duck integration options conducted and documented	Dec 2013 Jun 2014 Mar 2015	R1-100% R2-100% R3-100%	May-13 Jun-15 Sept-15
M6	Participatory assessments of, and reflections on, introduced technologies conducted and documented and next steps drawn up	Dec 2013 Jun 2014 Mar 2015	R1-100% R2-100% R3-100%	Mar-13 May-15 Jun-15

**Output 5 - Increased capacity of interested farmers in Tambul community for using improved pig and chicken feeding practices based on sweet potato:** Two interventions identified to address objective 5 are – (i) improved management and feeding of local pigs based on efficient utilization of sweet potato as silage feed for grower pigs, and (ii) improved management and feeding of broiler chickens and or layer birds (village chickens) based on sweet potato.

(i) *Improved management and feeding of local pigs based on efficient utilization of sweet potato silage for grower pigs.*

The introductions of preferred intervention involved a series of activities targeting six milestones was successfully achieved through three rounds of model farmers conducted from January 2013 to December 2015. The strategic aim was to increase the resilience of smallholder village farming systems by enabling efficient feed storage and maximized use of available sweet potato crop harvest as livestock feed, particularly for grower pigs. Identification and selection (**M1**) for initial and subsequent rounds of model farmers were conducted based on two levels – first community leaders identify and recommend to the project site coordinating team list of potential farmers within their communities, second the project site coordinating team carried out physical on-farm visits including needs assessment and made the final selection using an eight point selection criteria (Table 1); which was also used for selection of farmers for other interventions.

**Table 1: Selection criteria used in the selection of model farmers for on-farm demonstration of technologies**

No.	Lead model farmer selection	Yes	No
1	Past experience/farming expertise/hardworking	<input type="checkbox"/>	<input type="checkbox"/>
2	Innovative & must/can be a role model	<input type="checkbox"/>	<input type="checkbox"/>
3	Willingness to participate & share information	<input type="checkbox"/>	<input type="checkbox"/>
4	Able to communicate	<input type="checkbox"/>	<input type="checkbox"/>
5	Good behavior/ trustworthy/ acceptable to community	<input type="checkbox"/>	<input type="checkbox"/>
6	Have existing stocks (pig, poultry, fish)	<input type="checkbox"/>	<input type="checkbox"/>
7	Willing to meet 50% of on-farm cost	<input type="checkbox"/>	<input type="checkbox"/>
8	Residency and proximity in the community	<input type="checkbox"/>	<input type="checkbox"/>

**M2** was successfully conducted for three rounds of farmers comprising 5 pig trainings for 163 interested farmers with 23 selected model farmers for on-farm demonstration of the technology. The trainings were combined with those for other inter interventions – poultry and fish duck integration using appropriate training manuals developed including posters, and covered basic husbandry and feeding practices including practical demonstration of the silage technology. Other important aspects of husbandry practices such as improved health and disease, basic selection practices, and better housing were also included in the trainings. An important approach that promotes great impact in the participatory learning process was the engagement of model farmers who had vast experience in pig farming as well as displaying confidence in the application of the technology amongst the previous rounds to train subsequent rounds of selected farmers including other interested farmers in the communities. This approach was applied for all other preferred interventions. Selected model farmers were assisted with materials for silage preparation. The distribution of materials followed recommendations from the physical farm visits and assessments and training information. Selected farmers were given ample time to set up their sheds ready for on-farm demonstrations (**M3**) using local materials. Specifications were given during the training and include a set up with two 2mx2m rooms. Those who already have appropriate structures in place were tasked to make preparations ready for on-farm demonstration for **M5**. Model farmers were asked to use their own stocks for on-farm demonstrations (**M4**). The successful completion of **M5** for three rounds of farmers involve comparative assessment of farmers’ usual practice against the improved method using various number of grower pigs. Farmers’ own diet comprised mostly of cooked sweet potato (boiled) fed either solely or blended with fish meal or stock feed<sup>1</sup>, kikuyu grasses and kitchen wastes, with occasional grazing using tethering method and housed at night time. There was no restriction set on this system and farmers were allowed to raise the test animals using their usual way of raising them. The introduced diet comprised of sweet potato vine and leave silage blended with NARI Broiler Concentrate placed on old dishes and offered on a daily basis and gradually increased over monthly intervals. Clean water was also provided *ad lib* and the pens were cleaned on a daily basis. An added activity under **M5** was the implementation of five farmer field schools across the two sites lead by the model farmers themselves and facilitated by project site staffs. This activity proved to be useful to re-enforce the essential skills and knowledge in livestock farming. It also allows illiterate farmers to learn from early adopters and model farmers. Of the 23 selected model farmers, 22 successfully participated in the on-farm demonstrations. Most rounds 3 and 4 model farmers for pigs however were unable to fully complete the cycle due to the onset of severe frost incidence in 2015 and 2016. The performance results from 22 model farmers are presented in the site technical report. The completion of each round of farmers involved participatory assessments of, and reflections on introduced technologies and farmer perceptions, including selection of subsequent rounds of farmers (**M6**).

<sup>1</sup> Commercial feeds based on imported high value grains

(ii) *Improved management and feeding of broiler chickens and or layer birds (cross bred chickens) based on sweet potato.*

The preferred options identified under this sub-objective were applied on broiler for meat and crossbreds of local x commercial shaver brown chickens for egg production. The interventions were successfully completed for three rounds of selected model farmers with no major hindrance from March 2013 to November 2015. High poultry feed cost due to increasing cost of imported grain feed ingredients used in commercial feeds poor availability are major factors affecting small scale poultry farmers who rely on the generated income to support themselves in times of need. The strategic aim was to increase and enable the selected model farmers to efficiently use sweet potato as major diet for poultry thereby reducing cost of production. Like for pig interventions, the approach used involved a series of activities targeting six major milestones. Two stages of farmer identification and selection (**M1**) for each of the three rounds were carried out successfully. **M2** was also conducted successfully for a total of 56 interested and 23 selected model farmers. The training covered important aspects of poultry - improved husbandry and feeding practices as well as practical demonstration of the technology. Model farmers who were engaged in previous rounds were used to train subsequent farmer groups. Interested farmers for pigs and fish-duck integration also attended as the trainings were conducted concurrently. For **M3** selected farmers were assisted with materials (eg. wires) to subdivide their sheds into two 2mx2m rooms for on-farm demonstration study (**M5**) comparing - (a) commercial feed verses introduced NARI concentrate blended with sweet potato for broiler chickens in confinement, and (b) semi-intensive with occasional feeding for crossbred against the introduced NARI concentrate blended with sweet potato for broiler chickens in confinement. **M4** was completed successfully with the distribution of 350 broilers and 105 cross bred chickens to four to 19 model farmers for on-farm assessment. Technical results of on-farm studies are presented in the site technical reports. Three farmer field days were organized and conducted by model farmers and facilitated by the project site coordinating team. **M6** involving participatory assessments were also achieved successfully for all three rounds of farmers. A scientific paper is currently being prepared for publication.

**Objective 6: Increased capacity for using integrated livestock farming practices for inland fish and duck production by selected farmers in Tambul communities.** The integrated livestock farming practice involved the introduction of GIFT tilapia fish which is the most preferred and emerging fish cultured species in the region because of its fast growth rate and high tolerance to different climatic conditions. Unlike fish monoculture where most people are familiar with the Integration of fish and duck is a new concept that provided diversified options for the farmers in terms of protein and cash income. Participatory research action approach used was similar to those for pigs and poultry. **M1** involving two stages of selection of model farmers for three rounds were conducted successfully. **M2+3** were completed with the training of 40 interested farmers including 23 selected model farmers. Farmers were trained on basic husbandry and feeding practices and integration systems involving fish and duck. Each group of model farmers were tasked to prepare their farms and were monitored by the project site coordinating team, after which 3200 GIFT tilapia fingerlings were distributed to them. For **M4** about 22 model farmers were able to successfully completed on-farm assessment of integration (**M5**). The participatory assessment (**M6**) of and reflection on the interventions for rounds of model farmers were also successfully completed in time although two farmers were affected by the recent severe frost incidence. This step was considered useful as it not only assesses the successes of the model farmers but also enables the research team to evaluate the step-by-step processes involve and made recommendations to help the subsequent rounds of farmers.

**Table 2: General achievements for Tambul sites**

Output	Type of training	Material support to model farmers	No training conducted	No. farmers trained	Selected model farmers	On-farm demo completed
Increased capacity for using improved pig feeding and management practices based on SP	Improved management & feeding practices for pigs	LE broiler concentrate	5	163	23	15
Increased capacity for using improved chicken feeding and management practices based on SP	Improved management & feeding practices for broiler/ cross bred layer chickens	Broilers Cross bred layer chickens Concentrates	2	56	23	23
Increased capacity for using integrated livestock farming practices for inland fish and duck production	Fish-duck integration	Muscovy ducks Tilapia Fish fingerlings	2	40	23	22
			9	259	69	60

## (ii) KOPAFO SITE

There were two main outputs for livestock are;

1. Output 1: *Increased capacity of interested farmers in Kopafu community for using improved pig and goat feeding practices*
2. Output 2: *Increased capacity of interested farmers in Kopafu community for using improved chicken feeding practices*

KOPAFO SITE				
<i>Output 1: Increased capacity of interested farmers in Kopafu community for using improved pig and goat feeding practices</i>				
<b>(a) Improved management and feeding of local pigs based on sweet potato</b>				
	Milestone	Expected date of achievement	Achievement (%) at reporting period	Actual date of achievement
M1	Interested pig model farmers identified and essential baseline data on pig management established	Apr 13 Apr 14 Apr 15	R1-100% R2-100% R3-100% R4-100%	Apr-13 Nov-13 Mar-14 Apr-14
M2	Nominated model and control pig and control farmers trained in improved pig feeding practices	Apr 13 Apr 14 Apr 15	R1-100% R2-100% R3-100% R4-100%	Sep-13 Feb-14 Mar-14 Apr-14
M3	Up to five nominated model farmers per year set up and demonstrate improved pig feeding systems	Apr 13 Apr 14 Apr 15	R1-100% R2-100% R3-100% R4-100%	Sep-13 Mar-14 Apr-14 Aug-14

M4	NARI officers conduct monitoring visits to the model farms	Sept 13 Sept 14 Sept 15	R1-100% R2-100% R3-100% R4-100%	Oct-13 Apr-14 Aug-14 Oct-14
M5	Participatory joint assessments and reflections on use of introduced feeding practices conducted and next round of model farms identified	Nov 13 Oct 14 Oct 15	R1-100% R2-100% R3-100% R4-100%	Nov-13 Apr-14 Aug-14 Oct-14
<b>(b) Improved management and feeding practices for goats</b>				
M1	Interested goat model farmers identified and essential baseline data on goat management established	Apr 13 Apr 14 Apr 15	R1-100% R2-100%	Apr-13 Apr-14
M2	Nominated model and control pig and control farmers trained in improved goat feeding practices	Apr 13 Apr 14 Apr 15	R1-100% R2-100%	Sep-13 Apr-14
M3	Up to five nominated model farmers per year set up and demonstrate improved goat feeding systems	Apr 13 Apr 14 Apr 15	R1-100% R2-100%	Sep-13 May-14
M4	NARI officers conduct monitoring visits to the model farms	Sept 13 Sept 14 Sept 15	R1-100% R2-incomplete	Oct-13 Oct-14
M5	Participatory joint assessments and reflections on use of introduced feeding practices conducted and next round of model farms identified	Nov 13 Oct 14 Oct 15	R1-100% R2-incomplete	Nov-13 -
<i>Output 2: Increased capacity of interested farmers in Kopafu community for using improved chicken feeding practices</i>				
M1	Interested chicken model farmers identified and essential baseline data on chicken management established	Apr 13 Apr 14 Apr 15	R1-100% R2-100% R3-100%	Apr-13 Sep-13 Nov-13
M2	Nominated model and control chicken farmers trained in improved chicken feeding practices	Apr 13 Apr 14 Apr 15	R1-100% R2-100% R3-100%	May-13 Sep-13 Feb-14
M3	Up to five nominated model chicken farmers per year set up and demonstrate improved chicken feeding systems	Apr 13 Apr 14 Apr 15	R1-100% R2-100% R3-100%	May-13 Sep-13 Jun-14
M4	NARI officers conduct monitoring visits to the model farms	Sept 13 Sept 14 Sept 15	R1-100% R2-100% R3-100%	Jun-13 Oct-13 Jun-14
M5	Participatory joint assessments and reflections on use of introduced feeding practices conducted and next round of model farms identified	Nov 13 Oct 14 Oct 15	R1-100% R2-100% R3-100%	Sep-13 Nov-13 Aug-15

Sweet potato silage was considered a relevant technology for mitigating the effects of climate change at Kopafu since the area, unlike the Tambul sites, is generally dry with prolonged drought periods. The idea of using this technology was to increase the resilience of subsistence farmers through efficient feed storage techniques and maximized use of the available sweet potato harvests for pigs and goats. These were carried out through participatory research action approach and involved a series of five milestones planned out under output 1.

**Output 1 - Increased capacity of interested farmers in Kopafu community for using improved pig and goat feeding practices.** Planned activities under each milestone (M1 to M5) were successfully completed for four rounds of selected pig model farmers from April 2013 to Oct 2014. A total of 21 farmers were trained and 13 were selected for on-farm demonstrations of which 5 successfully completed the cycle. Planned activities were also implemented concurrently for improved management and feeding practices for goats which involve two rounds of selected farmers. M1 to M5 for round 1 goat model farmers was successfully completed from Apr to Nov 2013 after which a participatory joint assessment was conducted. Only three model farmers successfully completed the on-farm demonstration for round 1. It was later revealed during the joint assessment that the use of SP silage as feed for goats did not gain much interest as it is laborious and time consuming compared to the conventional open grazing and tethering system. As a result focus was adjusted to cover only improved husbandry and pasture management practices including better housing and fencing. M1 to M3 for the second 2 goat model farmers was successfully completed. Yet again lack of commitment and reduced interest shown by the farmers resulted in the termination of activities for M4 and M5. Goats farming according to farmers do not require much attention as do pigs as they can graze on their own.

**Output 2 - Increased capacity of interested farmers in Kopafu community for using improved chicken feeding practices.** Planned activities for output 2 were successfully completed in August 2014. Three groups of farmers were selected by the community to try out the NARI low energy concentrate technology. Rounds 1 and 2 were completed in 2013 and involved a training and demonstration of NARI low energy concentrate with sweet potato for four broiler chicken farmers including one farmer who wished to test the diet using his commercial layer chickens. The third round of mainly three farmers that was completed in 2015 used the concentrate with sweet potato for local chickens. A total of 26 interested farmers were trained.

Based on the last participatory joint assessment for all livestock interventions, a combined training was conducted at the end of 2015 covering basic livestock husbandry practices for pigs, goats and poultry for 42 interested farmers who did not attend the previous training and demonstration sessions. This adds up to a total of 108 trained farmers under the livestock component for the Kopafu site.

**Table 3: General achievements for Kopafu site**

Output	Type of training	Material support to model farmers	No. training conducted	No. farmers trained	Selected model farmers	On-farm demo completed
Pigs	Improved management & feeding practices for pigs	Buckets (silage bins), netting wire, concentrate, copra meal	1	21	13	5
Goat	Goat management, silage feeding and improved pasture management	Pig net wire, nails	1	19	8	3



Chicken	Improved management & feeding practices using concentrate blended with SP	Concentrates, wire, nails	1	26	11	8
	General livestock husbandry practices		1	21 male 21 females		
Total			4	108	32	16

### (iii) DERIN SITE

DERIN SITE				
<i>Output 2: Increased capacity of interested farmers in Derin community for using improved pig feeding and management practices</i>				
<b>(i) Pig management &amp; feeding practices</b>				
	Milestones	Expected date of achievement	Achievement (%) at reporting period	Actual date of achievement
M1	Interested pig farmers identified and essential baseline data on pig management established	June 13 July 14 July 15	R1 -100% R2 -100%	Aug-13 Jun-14
M2	Nominated model pig farmers have skills and knowledge in improved pig feeding and management practices	Aug 13 July 14 July 15	R1 -100% R2 -100%	Sep-13 Jan-14
M3	Nominated model farmers set up and practice improved ways of pig management	Oct 13 Sept 14 Sept 15	R1 -100% R2 -100%	Nov-13 Jun-14
M4	NARI and DPI officers conduct monitoring visits to the model farms	Oct 13 Sept 14 Sept 15	R1 -100% R2 -100%	Nov-13 Jun-14
M5	Participatory joint assessments and reflections on use of introduced practices conducted and next round of model farms identified	Dec- 13 July 14 July 15	R1 -100% R2 -100%	Nov-13 Nov-14
<b>(ii) Fish-duck Integration</b>				
M1	Interested farmers and suitable sites for integrated poultry-fish pond units identified and established	Jan-14	R1-100%	Jun-14
M2	Selected model farmers provided with hands-on training in the set up and operation of integrated pond units	Jan-14	R1-100%	Jan-14
M3	Integrated farm units (pond, shed, structures) constructed and made operational	Jan-14	R1-100%	Jun-14
M4	Suitable stocks (fish, duck) acquired and established by the participating model farmers	Jun-14	R1-100%	Jun-14

M5	On-farm demonstrations and evaluations of introduced fish-duck integration options conducted and documented	Sep-14	R1-100%	Nov-14
M6	Participatory assessments of, and reflections on, introduced technologies conducted and documented and next steps drawn up	Dec-14	R1-100%	Jun-14

**Output 2 - Increased capacity of interested farmers in Derin community for using improved pig feeding and management practices.**

*(i) Intervention 1: Improved pig management and feeding practices*

Improved pig management and feeding practices was primarily the preferred option identified and five milestones were formulated to deliver this output under the livestock component. These milestones were achieved well within the set time frame with two groups of selected farmers. **M1** which involve initial baseline assessment conducted for the first round of farmers showed that pigs are widely left to fend for themselves contributing to its low productivity. Further, the animals have posed problems of causing damages to community gardens creating local disputes among villages. The animals were also reported to have caused waste pollution on fresh water streams used by the community. Hence the trainings under **M2** covered three basic aspects of pig farming – pig nutrition and improved feeding practices using sweet potato, animal welfare and management, and animal health and diseases. A total of 27 (6 females: 21 males) interested farmers were trained including 10 (1 female: 9 males) selected model farmers. Of the 10 selected model farmers, 3 farmers successfully complete the on-farm demonstration participatory research cycle. **M3** to **M5** were successfully completed within the set time frame possibly due to help from the local DPI, site project staff and a supportive community leader. Participatory assessment for the first round of model farmer showed slow uptake of the technology. It was observed that most farmers in general are not risk takers or are undecided to participate. Implementation of activities for **M1** to **M5** for round 2 pig model farmers were successfully completed in November 2015. Although it took a longer time to be completed, however, it was completed within the time frame. This was due to the fact that most selected farmers took time to make preparations for on-farm demonstrations. Conversely, during the participatory joint assessment session, it is important to note farmers' satisfaction by using improved management and feeding practices. Most participants indicated that they had reduced damages to their gardens and the villages were free from animal wastes as compared to the past experiences.

*(ii) Intervention 2: Integrated fish-duck farming practices*

Revised plan the site was done after the completion of participatory joint assessment activity for round 1 pig farmers due to increased interest from the community for the inclusion of fish duck integration. The site is primarily wet with excessive water log areas suitable for inland fish farming. Planned activities were adopted version of activities for fish-duck integration conducted in some of the PNG sites. **M1** and **M2** were successfully completed and trainings were conducted together with round 2 pig farmers covering basic husbandry and feeding practices for pigs and inland fish farming. The combine training was attended by a combine total of 34 participants of which 24 percent were female. Three model farmers were selected and trained since they already have had inland fish ponds previously dug out with assistance from the community to raise and supply fingerlings, but were struggling to obtain adequate stocks as they lack the capacity and skills to continue. **M3** was omitted since they already have fish ponds ready and **M4** was successfully completed with the initial support of 160 GIFT tilapia fingerlings distributed by the project. On-farm activities for **M5** involved

but not limited to increased capacity of the farmers to multiply and distribute of fingerlings to other interested farmers throughout the community.

#### (iv) MURUKANAM SITE

<b>MURUKANAM</b>				
<i>Output 1: Increased capacity for using integrated livestock farming practices for inland fish, ducks and chicken production by selected farmers in Murukunam community</i>				
<b>(i) Fish-duck integration</b>				
	Milestones	Expected date of achievement	Achievement (%) at reporting period	Actual date of achievement
M1	Interested model farmers and suitable sites identified for integrated livestock units (fish-duck, chicken) and baseline established	May 2013 March 2014 March 2015	R1-100% R2-100% R3-100%	May-13 Mar-14 Mar-15
M2	Participating model farmers trained in the set up and operation of integrated units	May 2013 March 2014 March 2015	R1-100% R2-100% R3-100%	May-13 Mar-14 Mar-15
M3	Integrated farm units (pond, shed, structures) constructed	May 2013 March 2014 March 2015	R1-100% R2-100% R3-terminated	May-13 Mar-14 -
M4	Basic supply of breeding stock acquired by participating farmers with assistance of the project (ducks, chicken, fingerlings)	July 2013 June 2014 June 2015	R1-100% R2- terminated R3- terminated	Jul-13 - -
M5	Participatory assessment of integrated units conducted	Oct 2013 Oct 2014 Oct 2015	R1-100% R2- terminated R3- terminated	Oct-13 - -
<b>(ii) Local chickens</b>				
M1	Interested model farmers and suitable sites identified for integrated livestock units (fish-duck, chicken) and baseline established	May 2013 March 2014 March 2015	R1-100% R2-100%	May-13 Mar-14
M2	Participating model farmers trained in the set up and operation of integrated units	May 2013 March 2014 March 2015	R1-100% R2-100%	May-13 Mar-14
M3	Integrated farm units (pond, shed, structures) constructed	May 2013 March 2014 March 2015	R1-100% R2-100%	May-13 Mar-14
M4	Basic supply of breeding stock acquired by participating farmers with assistance of the project (ducks, chicken, fingerlings)	July 2013 June 2014 June 2015	R1-100% R2-100%	Jul-13 Jun-14
M5	Participatory assessment of integrated units conducted	Oct 2013 Oct 2014 Oct 2015	R1-100% R2-100%	Oct-13 Oct-14
<i>Output 2: Improved capacity for using integrated goat -coconut system by selected farmers</i>				
M1	Interested model farmers and	May -13	R1-100%	May-13

	suitable sites identified for integrated livestock units (goats-coconuts) and baseline established	Mar -14 Mar-15	R2-100%	Mar-14
M2	Participating model farmers trained in the set up and operation of integrated units	May -13 Mar-14 Mar-15	R1-100% R2-100%	May-13 Mar-13
M3	Integrated farm units (sheds, feeding racks) constructed	May-13 Mar-14 Mar-15	R1-100% R2-terminated	May-13 -
M4	Basic supply of breeding stock acquired by participating farmers with assistance of the project (foundation breeding stock)	July-13 Jun-14 Jun-15	R1-100% R2-terminated	Jul-13 -
M5	Participatory assessment of integrated units conducted	Oct -13 Oct -14 Oct -15	R1-100% R2-terminated	Oct-13 -

**Output 1: Increased capacity for using integrated livestock farming practices for inland fish, ducks and chicken production by selected farmers in Murukunam community.** Preferred options and interventions for integrated livestock farming practices were identified and variations were made on the site project plan. The main interventions relevant to the set objective include – (i) fish-duck integration and (ii) poultry-crop integration practices, and these were conducted concurrently. Implementation of planned activities under each milestone (**M1+2+...5**) for the initial round 1 model farmers were successfully completed from May 2013 to Oct 2013. Eleven genuine farmers (9males: 2 females) were identified by the local project staff in collaboration with the community leader. These farmers were trained on improved management and feeding practices for various identified the livestock and were adequately supported by the project. However, the second and third rounds of model farmers were terminated before they actually complete the whole participatory research action cycle. Further, even though the initial milestones (**M1+2**) were successfully achieved for rounds 2 and 3 involving 32 farmers (23 males: 9 females), accomplishing **M3+4+5** was quite a challenge as farmers were unable to complete preparatory activities ready on time for on-farm demonstrations which were eventually terminated. It was later known that farmers lost interest in continuing the activities as they place more of their time towards cocoa production due to increased prize.

**Output 2: Improved capacity for using integrated goat - coconut system by selected farmers.** Integration of goat under coconut plantations was the second priority intervention voted by the community during the initial consultation exercise. However, this priority interest was not evident in the implementation phase. Six interested farmers for round 1 were initially identified (**M1**), trained (**M2**) and were tasked to make preparations for on-farm demonstrations which include **M3** - establishment of on-farm structures (night sheds, feeding racks). Only one farmer was able to complete **M3** and was supported with the distribution of foundation stocks (4 doe goats & 1 buck). The farmer was able to multiply his stock numbers from 5 to 15 goats. **M5** was successfully completed in Oct 2013. The other five farmers who were unable to complete their goat farm structures were reported to have shifted their interest on cocoa as the market prize for cocoa increased. The increase in the market prize for cocoa which is the main source of income in the area seemed to take advantage over livestock farming because of the monetary value attached to it. This has also affected the implementation of planned activities for round 2 farmers who were successfully identified (**M1**) towards the end of **M5** for round 1. The planned activities for round 2 farmers were eventually terminated due to lack of farmer commitments.

## (v) HISIU/YULE ISLAND SITES

<b>HISIU/YULE ISLAND</b>				
<i>Output 7: Increased capacity of interested farmers in Hisiu/Yule community for using improved chicken and pig feeding and management practices</i>				
	Milestones	Expected date of achievement	Achievement (%) at reporting period	Actual date of achievement
M1	Interested farmers & suitable sites identified in both villages (Hisiu, Yule Is.) for livestock interventions (chicken, pigs) & baseline established	Mar-13	R1-100% R2-100% R3-100%	Mar-13 Mar-14 Aug-14
M2	Selected model farmers have skills and knowledge on improved husbandry practices (feeding, housing, health care and waste disposal)	Aug-13	R1-100% R2-100% R3-100%	Aug-13 Jun-14 Aug-14
M3	Basic materials acquired by participating farmers with assistance of the project & farm structures (broiler chicken, layer chicken, pigs) established	Aug-13	R1-100% R2-100% R3-100%	Aug-13 Jun-14 Sep-14
M4	Suitable production stock (chicken, pigs, ducks) acquired and maintained under improved management by the participating farmers for demonstration trials	Dec-13	R1-100% R2-100% R3-100%	Dec-13 Jun-14 Sep-14
M5	Participatory joint assessments and reflections on use of introduced practices conducted and next round of model farms identified	Mar-14	R1-100% R2-100% R3-100%	Mar-14 Aug-14 Dec-15
<i>Output 8: Livestock holdings of interested farmers in Hisiu/Yule Is. diversified and capacity for livestock management improved</i>				
	<b>a) Fish-duck Integration</b>			
M1	Interested model farmers and suitable sites identified for livestock diversification (goats, ducks, chicken) and baseline established	Sep-15	R1-100%	Jun-14
M2	Participating model farmers have knowledge and skills in the set up and operation of the selected livestock units	Sep-15	R1-100%	Jun-14
M3	Suitable farm structures established	Mar 2015	R1-100%	Jun-14
M4	Foundation breeding stock acquired by participating farmers with assistance of the project (goats, ducks, chicken)	Mar 2015	R1-100%	Sep-13

M5	Participatory assessment of livestock units conducted	March 2015	R1-100%	Dec-15
	<b>b). Goat Management</b>			
M1	Interested model farmers and suitable sites identified for livestock diversification (goats, ducks, chicken) and baseline established	Mar-13	R1-100% R2-100%	Jun-15
M2	Participating model farmers have knowledge and skills in the set up and operation of the selected livestock units	Mar-13	R1-100% R2-100%	Jun-15
M3	Suitable farm structures established	Aug-13	R1-100% R2-100%	Sep-15
M4	Foundation breeding stock acquired by participating goat farmers with assistance of the project	Aug-13	R1-100% R2-100%	Oct-15
M5	Participatory assessment of livestock units conducted	Dec-13	R1-100% R2-100%	Dec-15

**Output 7: Increased capacity of interested farmers in Hisiu/Yule community for using improved chicken and pig feeding and management practices.** Community leaders at both Hisiu & Yule were initially tasked to identify genuine farmers (**M1**) to trial out the preferred technologies for chickens and pigs. A combine training (**M2**) together with those for goats was conducted covering important aspects of livestock practices on poultry, pigs including goat, and practical demonstrations of relevant technologies. The community showed keen interest in the initial training attended by 48 (41male: 7 female) farmers for both sites. The selected farmers were supported with materials (wire, nails, tie wire and stocks) (**M3**) on a 50:50 basis to improve their farm establishments for on-farm testing of the technologies. For poultry, farm set ups include partitioning of farm sheds into two rooms for comparative observation of usual conventional feeding practices against the improved feeding technologies (**M4**). Other on-farm demonstrations include confinement with improved feed technologies verses the widely practiced free range system. SP silage blended with fish meal fed to pigs in confinement while locally formulated diets using local feedstuffs (fish meal, SP, rice bran, copra meal) was fed to poultry in comparison with conventional system. The poultry and pig improved management practices were demonstrated to be more beneficial over the free range production system. Due to the impact of climate change that had on food security at the household level, farmers had taken advantage on improving the traditional free range production system by confining the birds. The on-farm results are presented in the site technical report. The uptake of improved pig management and feeding practices was slow as farmers (particularly in Hisiu) prefer the local free ranging system, although two farmers have adopted the technology. The case for Yule island was thriving as a growing number of farmers (chicken and ducks) were adopting the technologies. The research cycle was successfully concluded after the completion of **M5** for round 1. It was revealed, however, that the selection of farmers (round1) was bias (especially in Hisiu) towards relatives of the community leader who conducted the initial selections. Hence the approach in the selection of farmers for subsequent rounds (2 & 3) was modified and farmers were selected based on recommendations from the community leaders as well as on physical farm visits conducted by project site staffs. **M1+2+...5** for rounds 2 & 3 pig, village chickens and ducks for both sites including fish for Hisiu were successfully complete in August 2014 and Dec 2015 respectively. A combine total of 111 farmers (88 males: 23 females) were trained, which include 61 (45males:16 females) and 50 (43males:7 females) farmers from Hisiu and Yule respectively. A total of 64 local

chickens, 5 ducks and 240 GIFT tilapia fingerlings were distributed to 12, 1 and 3 model farmers respectively for on-farm demonstration works including multiplication and further distribution to the community at Hisiu. For Yule, 65 local chickens and 10 ducks were distributed to 12 and 2 model farmers. Other model farmers used their existing stocks.

**Output 8: Livestock holdings of interested farmers in Hisiu/Yule Is. diversified and capacity for livestock management improved.** Preferred options for diversification for the two sites include improved management and feeding practices for goats. More interest for goat farming was shown by farmers in Yule island with 5 selected model farmer and in Hisiu with only one farmer (**M1**). These farmers attended combine trainings covering important aspects of improved livestock practices for goats, pig, poultry and fish. Only one round of model farmers was successfully completed for the sites. This is due to long period of time taken by the farmers to make preparations for on-farm assessments which include establishment of night sheds, fencing and pasture improvement (**M2** and **M3**). Further, unlike other PNG sites where rounds of farmers are independent of the other even though planned activities may be similar, the adopted approach was that model farmers for previous round of farmers would need to supply the next group with their initial start up stocks. So time did not warrant the selection and completion of activities for subsequent groups. For the initial round 5 goats were distributed to one farmer for Hisiu and 24 goats for five farmers at Yule Island. Participatory assessment for the only round of farmers for goats at both sites was successfully completed.

#### (vi) Selected sites for Solomon Islands

XXX Jules to provide technical reports

#### (vii) Selected sites for Vanuatu

XXX Antoine to provide technical reports

## 2. Modifications in implementation plans at sites for this component and overall component plan and why were the modifications necessary

- Inclusion of on-farm farmer field training under milestone 5 for the three livestock interventions for the two Tambul sites
- Inclusion of fish integration for Hisiu, Derin and Murukanam sites
- Due to unavailability of high/low energy poultry concentrates the universal concentrates were used as a substitute in poultry feeding towards the end of the project.

## 3. Achievements for the overall Component objectives and Results – Provide the consolidated indicator information to support your statements on achievement of the Component Result/Objective

Planned **M5** for **result 4** was coordinated under the livestock component and the overall achievement is presented together with that for livestock component as shown below.

<b>Result 4: Diversification options for crop production and utilization available to smallholder communities in PNG, SI &amp; Vu in areas affected by moisture stress, excess precipitation, or saline soil conditions</b>	
A5	<i>Piloting of processing options of sweet potato and cassava for food, feed, storage</i>

N°	Expected Result/ Activity/ Milestone	Expected Date of achievemen t	Actual Date/ Time of achievemen t	Activity/ Output indicators
M1	Implementation of pilot site activities completed	Q4 2015	Q2 2015	<ul style="list-style-type: none"> <li>• Relevant data sheets, questionnaire for farmer selection developed and available</li> <li>• List of 26 farmers engaged</li> <li>• Mission reports of progressive site activities</li> <li>• Report on traditional practices for processing sweet potato &amp; cassava available</li> <li>• Site technical prepared &amp; available</li> </ul>
<b>Result 5: Livestock and fish production diversification options resilient precipitation deficits and/or deficits or soil salinity, and reliant on cost-effective locally produced feed/forages available to smallholder communities in PNG, SI and Vu</b>				
N°	Expected Result/ Activity/ Milestone	Expected Date of achievemen t	Actual Date/ Time of achievemen t	Activity/ Output indicators
A1	<i>Assessing the potential for improving farm productivity through diversifying livestock assets and improved cyclical use of crop and livestock inputs in situations where excess rainfall, moisture deficit or soil salinity conditions are problematic</i>			
M1	Preferred options for diversification and integrated use of resources are identified	Q1 2013	Q2 2013	<ul style="list-style-type: none"> <li>• List of identified options for diversification and integration and reported in technical reports for identified sites</li> </ul>
M2	Appropriate demonstration trials implemented by nominated model farmers	Q4 2013	Q4 2013	<ul style="list-style-type: none"> <li>• List of interested &amp; participating model farmers in demo per site, available in technical reports</li> <li>• Mission reports</li> </ul>
M3	Participatory technology assessment workshops held in all sites	Q1 2014	Q1 2013	<ul style="list-style-type: none"> <li>• Feedback reports compiled and available</li> </ul>
A2	<i>Sourcing and identifying forages tolerant of excess moisture and saline soil conditions, e.g. grasses, legumes and multipurpose shrubs such as Mulberry</i>			
M1	The need and type of forages identified	Q4 2013	Q2 2013	<ul style="list-style-type: none"> <li>• List of identified forage species -ie. Mulberry. Others include gliricidia &amp; leucena including <i>Brachiaria decumbens</i>, para, setaria and signal grasses introduced to Hisiu/Yule sites</li> </ul>
M2	Implementation of pilot site forage development and	Q4 2014	Q3 2015	<ul style="list-style-type: none"> <li>• List of farmers pasture establishments</li> <li>• Number of forages cuttings</li> </ul>



	assessment activities completed			distributed
A3	<i>Pilot test diversified livestock feeding systems and husbandry practices in smallholder communities in target communities in PNG, SI and Vu</i>			
M1	Implementation of pilot site improved feeding and management demonstration activities completed	Q3 2015	Q3 2013	<ul style="list-style-type: none"> <li>• Number of model farmers engaged</li> <li>• Documented results of demonstrations</li> <li>•</li> </ul>
M2	Implementation of preferred livestock integration activities completed	Q4 2015	Q4 2013	<ul style="list-style-type: none"> <li>• Number of model farmers engaged</li> <li>• Documented results of demonstrations</li> <li>•</li> </ul>
M3	Participatory technology assessment workshops held in all sites	Q4 2015	Q1 2014	<ul style="list-style-type: none"> <li>• Reports of workshops available</li> <li>•</li> </ul>
A4	<i>Assessing existing mechanisms for supplying breeding stock in PNG, SI, and Vu and demonstrating institutional or community-based breeding facilities</i>			
M1	Selected breeding stock of livestock supplied to model farmers and established	Q3 2015	Q2 2015	<ul style="list-style-type: none"> <li>• List &amp; numbers of relevant stocks distributed to preferred sites available in appropriate technical &amp; mission reports</li> </ul>
M2	Desktop review of breeding stock supply systems in PNG, SI, Vu	Q3 2015	Pending	<ul style="list-style-type: none"> <li>• Review completed and disseminated to relevant stakeholders</li> </ul>
M3	Stakeholder workshop on breeding stock supply systems held in PNG	Q4 2015	Cancelled	
M4	Stakeholder workshop on breeding stock supply systems held in SI	Q4 2015	Cancelled	
M5	Stakeholder workshop on breeding stock supply systems held in Vu	Q4 2015	Cancelled	
M6	Policy brief submitted to relevant Government bodies in PNG, SI, Vu	Q4 2015	Cancelled	

The summaries of consolidated indicator information for each result under the livestock component are given in the Annex of this report.

The consolidated indicators regarding the numbers of farmers attending the type of learning workshops on specific technologies/practices are given in Annex 2.

Annex 3 presents the number of model farmers trying out improved management practices (pig, chicken, goat feeding and management, integrated pond units).

Annex 4 shows the number and type of livestock units supplied to primary and secondary users (within or surrounding communities).

#### 4. Technical Reports and other type of publication (popular or technical) produced or planned to produce (who will be responsible)

Type/title of document	writers <sup>2</sup>	remarks
<b>Journal/ Conference papers</b>		
Effect on Nutrient Digestibility and Nitrogen Balance in Grower Pigs Fed Three Forms of Blended Cassava Roots	<b>Dom. M</b> et. al	Journal Sustainable Livestock Production in the Perspective of Food Security, Policy, Genetic Resources and Climate Change
Nutrient Utilization in Grower Pigs fed Boiled, Ensiled or Milled Sweet Potato Roots, Blended with a Wheat based Protein Concentrate	<b>Dom. M</b> et. al.)	Asian Austral-asian Journal of Animal Sciences
Challenges in agricultural technology dissemination: experiences in the Western Highlands of PNG.	<b>Ahizo. J</b> & Lobao. M.	Abstract submitted to the UOG International Conference on Agricultural Extension in November 2016.
On-farm study on responses of juvenile tilapia ( <i>oreochromis niloticus</i> ) fish yields cultured under an integrated farming system tested in the high altitudes of Papua New Guinea	<b>Roberts. A</b> et. al	Abstract to be submitted to S&T Conference, NARI/Unitech in November 2016
Household processing of sweet potato, cassava and yam into flour: A case study at Kopafu communities, Eastern Highlands Province of Papua New Guinea	<b>Ramita, I</b> & Lobao. M	Abstract submitted to the Univ. Of Goroka International Conference on Agricultural Extension in November 2016.
Muscovy duck ( <i>C. moschate</i> ) and fish production in a small-scale integrated pond system under high-altitude conditions in Papua New Guinea, Western Highlands Province	<b>Roberts. A</b> & Baka, P	Intended for submission to Journal of South Pacific Agriculture
Utilization of Cassava ( <i>Manihot esculenta</i> Crantz) and Sweet Potato ( <i>Ipomoea batatas</i> ) as dietary sources for Broiler Chickens in Western Highlands, Papua New Guinea	<b>Ahizo. J</b>	Intended for submission to Journal of South Pacific Agriculture
<b>News articles in national news papers</b>		
Using Integrated Livestock Farming Practices For Inland Fish And Duck	<b>Roberts. A</b> et. al.	Published in NARI EUARD / Aug 2015

<sup>2</sup> Author(s) in bold are/will be responsible

Production.		
Benefits of locally produces livestock feed technology at Kiripia	<b>Ahizo. J</b>	Published, NARI/EUARD Project News 2016
Empowering drought affected communities	<b>Ahizo. J &amp; Amben. S</b>	Published, The National Focus Article/2016
Strategies for feeding for inland pond fish using local feeds	<b>Sine. M &amp; Roberts. A</b>	Published, The National Focus Article/11 Sep 2015
Improved use of local feed resources for mitigating the effects of escalating food prices in PNG: a contribution for food security policy dialogue	<b>Ayalew. W</b>	Published, The National Focus Article/ Oct 2015
Locally available feedstuffs for small livestock production	<b>Sengi. S</b>	Progressing
<b>Technical reports</b>		
Mitigating the effects of climate change by introducing an improved village pig feeding and management systems in Tambul, Papua New Guinea	<b>Amben, S &amp; Dom. M</b>	Submitted
Using integrated livestock farming practices for inland fish production to mitigate climate change effects in Tambul, Papua New Guinea	<b>Roberts, A</b>	Submitted
Increasing smallholder farmers' capacity for improved poultry feeding practices based on sweet potato in Tambul	<b>Ahizo. J</b>	Submitted
Increasing capacity of farmers in the Kopafo community using processing techniques and value addition of sweet potato and cassava for home consumption during prolonged dry seasons.	<b>Ramita. I</b>	Submitted
Improved livestock husbandry skills and stockmanship to mitigate the effects of climate change in Hisiu village and Yule Island, Central Province - Papua New Guinea.	<b>Sengi. S</b>	Submitted
Increased capacity of interested farmers in Kopafo community for using improved chicken feeding practices	<b>Solomon. E</b>	Submitted
Adaptation of livestock farming practices and technologies to enhance livelihoods in times of prevalent climate changes	<b>Tarabu. J</b>	Submitted
<b>Training manual/Extension materials</b>		
Fish-duck integration training module for Tambul smallholder farmers, NARI Livestock Research Centre, Tambul, PNG	<b>Roberts, A &amp; Sine, M</b>	Used in project trainings and ongoing NARI livestock farmers training programs
Village chicken, duck and goat farmers field school training module for Hisiu & Yule Island communities. NARI Livestock Research Centre, Laloki, PNG	<b>Sine. M &amp; Sengi. S</b>	Used in project trainings and ongoing NARI livestock farmers training programs

Training manual: Poultry and Pig Husbandry, Feeds & Nutrition Practical Hands-on Training. NARI Livestock Research Centre, Lae, PNG	?	Used in project trainings and ongoing NARI livestock farmers training programs
Poultry farmer-field school: Training module, Tambul, PNG	<b>Ahizo. J</b>	Used in project trainings and ongoing NARI livestock farmers training programs

## 5. Lessons learnt or any other relevant or notable observations as part of implementation

Prominent lesson learnt was that project site staffs struggled a little while as they took time to understand how to implement the planned activities for each of the identified options for the respective sites (particularly Kopafo, Hisiu/Yule and Derin/Murukanam), the appropriate cyclical approaches required and the expected results from the implementation processes. The issue is exacerbated further with the movement of staffs to other unrelated project areas even although most planned interventions were proven to be successfully achieved. However, some data for on-farm demonstration trials were missed out in some sites. Related to this issue is the irregular availability of staffs on-site who are able to constantly monitor the progress on selected model farmers and collect relevant data in sites like Kopafo, Hisiu/Yule, Derin and Murukanam. Successes achieved in all interventions in the Tambul sites and few for other PNG sites are possibly due to good awareness of the project site staffs in those locations.

Another important lesson that has significant impact on the successful implementation onsite is the commitment of reliable community leaders who help select genuine model farmers and are able to motivate and encourage them to implement what is required from the model farmers. Part of the achievements in sites like Derin, Yule and Tambul are a result of committed community leaders' engagement in the implementation process.

Further, the active role of collaborating partners such as the District DPI at Tambul sites and World Vision for Derin/Murukanam have contributed to the successful implementation of the interventions at those sites unlike other sites (Kopafo) which was obviously lacking.

It is important to note also that the reduced interest observed among some of our model farmers in some sites like Murukanam and Derin sites is not only associated with their preference for other high value farm enterprises such as cocoa. It was observed later that interest in one or two of the interventions (such as livestock integration) had increased. There seem to be two groups of farmers: - risk takers and risk averse farmers. The former are those who have shown their interest initially and engaged as model farmers. These farmers are anxious to trial out new ideas and technologies and hope that these new ways of farming practices could change or benefit them later on before they decide whether or not to adopt or not to adopt. Similar group of farmers are observed in other project sites especially in the highlands. The latter group seemed to be apparent among farmers in the two sites in Madang they seemed to wait and observe the performance and benefits gain by risk taking farmer who were engaged as model farmers before they decide whether to adopt or not to adopt. A standard farmer selection criterion taking into account such groups of farmers could have been done to identify suitable model farmers for onsite studies.

## 6. Other capacity building achievements in the component (organizational, individuals, research capacity etc)

There is no specific and planned capacity building activities under the component. Related capacity building action are generally on need base to support the implementation of planned activities identified for each site.

Capacity building actions achieved for organization, individuals, and research in the project sites include the following.

In PNG:

1. NARI Technical and project field staff  
Technical officers involved in the project were trained on a regular basis on the job over the duration of the project. This assistance greatly improved their capacity in to implement the livestock related interventions for the selected sites.
  - Related on-farm livestock participatory action research approach
    - i. Development of research protocols
    - ii. Development of training manuals
    - iii. Monitoring & evaluation of onsite research trials
    - iv. Data collection & analysis
    - v. Reporting
2. Project support provided for research activities (feed analysis) related to the project for a PhD student for NARI studying at the University of Adelaide. The student will remain with NARI and will be able to use his new knowledge and skills to develop research works related on a range of areas including climate, livestock practices and broaden the NARIs research scope.
3. Livestock related capacity building for collaborating District DPI officers
  - Livestock feed formulation
  - Feed ingredient mixing

In Solomon Islands:

1. Livestock related capacity building for MAL officers include a two days training on;
  - Livestock feed formulation
  - Feed ingredient mixing
2. The purchase of an incubator for Kastom Garden Inc. to supply poultry for project sites was accompanied with a week capacity building training covering
  - Specifications for incubator operations
  - Management & incubation of fertile eggs
  - Management of young chicks and ducklings
  - Feed and feeding practices
  - Health & disease control measures
  - Packaging and distribution of poultry

In Vanuatu:

1. Livestock related capacity building for DARD and Ministry of Livestock officers include a two days training on;
  - Livestock feed formulation
  - Feed ingredient mixing
2. The purchase of an incubator for VARTC to supply poultry for project sites was accompanied with a week capacity building training covering
  - Specifications for incubator operations
  - Management & incubation of fertile eggs
  - Management of young chicks and ducklings
  - Feed and feeding practices
  - Health & disease control measures

- Packaging and distribution of poultry
2. 2 wks on-the-job training on livestock management and feeding practices, feeding formulation, hatchery and feed milling operations, etc for one VARTC staff conducted at NARI, PNG

## Annex 1: Result 5.1- Farmers participating in learning workshops on types of technologies/practices and issued with certificate of attendance

Pilot site	1. Murkanam	2. Derin	3. Kopafo	4. Tambul	5. Hisiu/ Yule	6. Aruligho (SI)	7. Hunda/ Kena (SI)	8. Buma (SI)	9. Middlebush (Vu)	10. Esema (Vu) (Malafau)	11. Siviri (Vu)
Learning activity 1	Integrated farming of livestock to improve production	Practical farmer training in improved pig management and feeding, conducted in Derin on August 23 and 24 2013	Improved feeding of pigs and goats using sweet potato silage and available concentrates (last update Q4 14)	Improved management and feeding of pigs	Improve management and feeding of pigs and poultry	Broiler & Village poultry feeding training	Improve duck production	Village poultry training on Housing and feeding	Selected farmers trained on improved feeding for pigs and goats	Improved Management and Feeding of Chicken (2 groups)	Improved Management and Feeding of Chicken (2 groups) - Broiler farmers using broiler concentrates
Total no. of community members	11	25	21	48	40 (Hisiu) + 20 (Yule Is)	Not Supplied	10	30	20	?	10
no. of male community members	9	21	9	41	25 (Hisiu) + 18 (Yule Is)	Not Supplied	3	25	7	?	7
no. of female community members	2	6	12	7	15 (Hisiu) + 2 (Yule Is)	Not Supplied	7	5	13	?	4
Leaning activity 2	Integrated farming of livestock to improve production (goat-coconut)	Practical training on improved livestock & crop integration [fish & duck integration]	Growing broilers using local feed resources	Improved management and feeding of chicken	Improve management and feeding of pigs and poultry	Local pig feeding - silage	Improved Pig Production	Broiler feeding using NARI concentrate	Improved feeding using SP Silage	Improved Management and Feeding of pig	Improved Management and Feeding of pig (SP silage)
Total no. of community members	6	34	26	21	50	Not Supplied	8	30	23	?	19
no. of male community members	4	26	17	17	35	Not Supplied	7	25	7	?	14
no. of female community	2	8	9	4	15	Not Supplied	1	5	16	?	5

members											
Leaning activity 3	Integrated farming of livestock to improve production		Improved housing, management, feeding of poultry	Integrated pond farming of tilapia fish and ducks	Improve management and feeding of pigs and poultry, and integrated pond farming of tilapia & ducks	Local pig husbandry - housing, feeding and welfare	Improved Goat Husbandry	Village poultry training 2	hands-on training on pig silage making using SP vines & tuber		Farmers trained on improved management & feeding of poultry
Total no. of community members	32		12	29	56	15	6	24	43		13
no. of male community members	23		6	29	46	10	6	19	39		4
no. of female community members	9		6	0	10	5	0	5	4		9
Leaning activity 4			Improved housing, management & feeding of pigs	Improved management & feeding of chickens	On-site practical training on feed formulation for layer/meat birds, including mixing & pelleting of formulated diets	Local pig husbandry - housing, feeding and welfare		Introduction to Bee Keeping training Workshop	Workshop on how to setup a poultry (fencing, shed, feeding and water materials); understanding ratio of chicken stock to maximise production		Trained farmers on improved village chicken management, housing & feeding
Total no. of community members			54	20	22 (Hisiu) & 19 (Yule)	15		16	46		31
no. of male community members			28	15	13 (Hisiu) & 11 (Yule)	10		14	37		21



no. of female community members			26	5	9 (Hisiu) & 8 (Yule)	5		2	9		10
Leaning activity 5				Improved management and feeding of pigs		Participatory evaluation of broiler feeding trial					
Total no. of community members				25		22					
no. of male community members				19		13					
no. of female community members				6		9					
Leaning activity 6				Improved management and feeding of pigs		Village Chicken Nutrition and Feeding Workshop					
Total no. of community members				35		31					
no. of male community members				9		22					
no. of female community members				26		9					
Leaning activity 7				Integrated pond farming of tilapia fish and ducks		Pig Nutrition and Feeding Workshop					
Total no. of community members				30		39					

no. of male community members				28		30					
no. of female community members				2		9					
Learning activity 8				Improved management and feeding of chicken							
Total no. of community members				25							
no. of male community members				15							
no. of female community members				10							

**Annex 2: Result 5.2: Number of model farmers trying out improved management practices (pig, chicken, goat feeding and management, integrated pond units)**

pilot site	1. Murkanam	2. Derin	3. Kopafo	4. Tambul	5. Hisiu/ Yule	6. Aruligho (SI)	7. Hunda /Kena (SI)	8. Buma (SI)	9. Middlebush (Vu)	10. Esema (Vu) (Malafau)	11. Siviri (Vu)
1. Type of improved practice	Integrated livestock farming fish-duck; duck-rice; pig-vegetables; chicken-vegetables	pig feeding and management practices	Using sweet potato silage to enhance growth of pigs and goats	Improved management and feeding of pigs	Community decided to continue with the traditional scavenging of village pigs, and not prepared to tethered feeding or housing.	Poultry feeding and management practices	Village chicken Husbandry	Village poultry training on Housing and feeding	Management & feeding of pigs using SP silage	Feeding/ Management of chicken (2 groups)	Feeding/ Management of chicken (2 groups)
Total no. of community members	7	10	2	7		6	6	6	3	14	11

no. of male community members	5	9	1	7		6	5	5	1	4	7
no. of female community members	2	1	1	0		0	1	1	2	10	4
2. Type of improved practice	3 initiated, but only one managed to complete preparations and received goats	Improved livestock crop integration	growing broiler using local feed resources)	Improved management and feeding of chicken		SP silage for pig feeding		Broiler feeding using NARI concentrate	Value addition of SP & banana into Livestock feed	Feeding/ Management of pigs	Feeding/ Management of pigs
Total no. of community members	1 progressing	2	10	11		1		4	5	3	5
no. of male community members	0	2	7	8		1		3	2	3	4
no. of female community members		0	3	3				1	3	1	1
3. Type of improved practice			4 (2M:2F) initiated, but only 2 males completed on-farm study	Integrated pond farming of tilapia and Muscovy ducks		Local pig husbandry housing, feeding and welfare		Village poultry			Village chicken housing & feeding
Total no. of community members			2	10		10		7			7
no. of male community members			0	10		8		5			2
no. of female community				0		2		2			5

members											
4. Type of improved practice				Integrated pond farming of tilapia and pigs		Village Chicken Nutrition and Feeding Workshop		Aquaculture (Tilapia)			
Total no. of community members				3		6		2			
no. of male community members				3		2		2			
no. of female community members				0		4		0			
5. Type of improved practice						Pig Nutrition and Feeding Workshop		Introduction to Bee keeping training Workshop			
Total no. of community members						5		4			
no. of male community members						4		3			
no. of female community members						1		1			
6. Type of improved practice								Pig Feeding Trial			
Total no. of community members								5			

no. of male community members								2			
no. of female community members								3			

### Annex 3: Result 5.3: Number and type of livestock units supplied to primary and secondary users (within or surrounding communities)

pilot site	1. Murkanam	2. Derin	3. Kopafa	4. Tambul	5. Hisiu/ Yule	6. Aruligho (SI)	7. Hunda/ Kena (SI)	8. Buma (SI)	9. Middlebush (Vu)	10. Esema (Vu)	11. Siviri (Vu)
1. livestock species	Ducks			1. Crossbred chickens	1. Chicken	Broiler birds/ Village poultry	Village Chicken	Broiler chicken	local chickens	local chicken (day-old)	local chicken (day-old)
no. of units target/actual	15 ducks (12 females and 3 males);			55 (52F:3M)	12 hens and 3 cockerels of village chicken for three farmers and 28 commercial layer hens for two other farmers	300/	120	200	68	33	25
no. primary users	3			6	5	6	6	4	7	?	?
no. secondary users					0	0					
2. livestock species	Tilapia fingerlings			Tilapia fish fingerlings	2. ducks	village chicken	Duck	Village chicken		local chicken	Broiler chickens
no. of units target/actual	160 GIFT Tilapia fingerlings;			3200	12 ducks and 3 drakes for three farmers	42	15	220		20	500?
no. primary users	3 fish farmers to received about 50 fingerlings each			8	3 duck farmers	4	6	14		2	10
no.	0			0	0						

secondary users											
3. livestock species	goat			Ducks	3. goats	Village Chicken (Layers)		Mosambique Tilapia sp			Village chicken
no. of units target/actual	5 goats (4 females and 1 male);			38	16 does and 4 bucks for three farmers	96		200			112
no. primary users	1 goat farmer received 4 females & 1 male goat			10	four goat farmers	6		2			
no. secondary users	at least 1 other goat farmer										
4. livestock species				Crossbred chickens; Broiler day old chicks	Village chicken (VC) s & Ducks	pigs Local Breed (Improved)		Bee keeping			Village chicken
no. of units target/actual				50 crossbred hens 7 x broiler DOC box	15 VC given to 3 model farmers for Hisiu; 10 ducks for 2 farmers each from Hisiu/Yule	10		10 Hives			30
no. primary users				9		5		4			3
no. secondary users											
5. livestock species								pigs			
no. of units target/actual								10 (pure breeds)			
no. primary users								10			
no. secondary users								5			

**Annex 4: Result 5.4: Number and list of new livestock and type of improved practices selected by >50% of participating farmers as appropriate for adoption into their own system base on 3 priority criteria**

pilot site	1. Murkanam	2. Derin	3. Kopafo	4. Tambul	5. Hisiu/Yule	6. Aruligho (SI)	7. Hunda/Kena (SI)	8. Buma (SI)	9. Middlebush (Vu)	10. Esema (Vu)	11. Siviri (Vu)
1. Type of livestock intervention (livestock species livestock management practice)	combining fish and duck farming in integrated units; use of SP an cassava for broiler feeding	3 pig feeding and management practices: separate pig shed; fencing of loafing yard; supplementary feeding.	3 pig and goat improved practices (supplementary feeding; separate housing; deworming)	pig management practices: pig housing (keeping pigs in protected pens; basic health care; silage making	3 chicken management practices (separate housing; supplementary feeding; nest boxes for laying eggs)	Chicken: Improved feeding (Formulated layer feed)	Muscovy Duck	Village chicken improve fencing and feeding	pig management practices: pig housing (keeping pigs in protected pens; basic health care; silage making		Village chicken feeding and management practices: Improved management, housing & low-cost feeding
major criteria (3 most important)	reduced feed cost; effectiveness	Convenience; cost effectiveness; simplicity.	effectiveness; affordability	better pig growth performance; better health care; less damage to gardens	Effectiveness; hygienic; can reduce predator attacks.	Improve egg production Feeding using formulated feed	Aquatic animal easy to look after	Good body shape and size	Convenience; cost effectiveness; simplicity.		Convenience, low cost, effectiveness (good growth, reduced mortality, profit was better)
2. Type of livestock intervention (livestock species livestock management practice)	4 goat management practices (goat house with raised flatted floor; supplementary feeding; fenced loafing yard)	Improved integration & management systems, use of local feeds for improved feeding of livestock	1. use of sweet potato of cassava in balanced broiler diets; 2. housing on a raised floor.	2 Chicken management practices: Improved feeding using SP; improved housing	4 duck management practices (Separate housing; supplementary feeding; nest boxes for laying eggs)	Pigs: Improved feeding (Formulated grower feed)		Concentrate and cassava feeding	Processing pig silage using SP vines & tuber		Pig feeding and management: Improved management, housing & feeding using local materials
major criteria (3 most important)	effectiveness; no damage to crops from roaming goats		effectiveness; affordability/ lower cost	1. round: Lower cost of feeding; broiler growth remains good; less chicken mortality	Effectiveness; hygienic; can reduce predator attacks.	Improve growth rate of growing animals		Cheaper feed option	Fast growth rate; improved housing, fencing & feeding		Convenience, low cost, readily available feed stuffs

				2. round: Broiler:- Lower cost of feeding; broiler growth remains good; less chicken mortality; Layers:-Lower feed cost, good egg production, less mortality					practice using silage; improved feeding container/storage		
3. Type of livestock intervention (livestock species livestock management practice)	Improved integration & management systems, use of local feeds for improved feeding of livestock		Improved management, housing & feeding practices for poultry	Improve integrated pond management, fish-duck husbandry & feeding systems	2 goat management practices (Separate housing; supplementary feeding)			Good hygiene and feeding	Improved management & improved feeding using SP and local resources		Pig feeding practice
major criteria (3 most important)			Improved production, reduced mortality, effectiveness & low cost system of poultry feed	Diversified protein source; effectiveness; low cost system	effectiveness; hygienic; can reduce damage to gardens			Good body shape and size			
4. Type of livestock intervention (livestock species livestock management practice)			Low-cost feeding using SP silage (for pigs)	9 poultry farmers selected use of SP+ concentrate for broilers/layer; raised slatted floor shed for broiler raising; raised layers indoors.	integrated fish & duck and supplementary feeding			Pigs: Improved feeding for grower feed	feed improvement & housing technology		
major criteria (3 most important)				<b>Broiler:-</b> Lower cost of feeding; broiler growth remains good;	Diversification, convenience, simplicity			increase growth rate of animal for	Feeding methods/ egg production/		



