Seeds of Life
Fini ba Moris

Commissioned Study

To inform and guide national policies on food and seed security

Benefits of Targeted vs Non-Targeted Seed Distribution

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Background

The Technical Advisory Group (TAG) which advises the Ministry of Agriculture and Fisheries' (MAF's) Seeds of Life III Program (MAF-SoL) recommended that MAF-SoL complete a series of studies which focus on issues which have the potential to influence and guide Timor-Leste's national food security policy, and its underlying national seed production and distribution policy. This recommendation reflects the TAG's (and other Development Partners') concerns that some current policies (such as rice importation and price subsidization) are impacting negatively on sectoral development initiatives, such as MAF-SoL's introduction of new staple food crop[1] varieties and MAF's plan to refurbish damaged irrigation schemes[2].

Therefore MAF-SoL employed a Consultant[3] to complete four studies[4]:

(i) An economic comparison of the impact of imported rice on the (irrigated[5]) rice production sector, and its cost-effectiveness, compared with investments in crop (production) inputs and distribution - to inform the food security policy;

(ii) An assessment of the effects on the agricultural sector of imported seed of untested varieties (which are) distributed free (to farmers) by MAF, compared with a research-based process of varietal identification (and associated) national seed production - to inform the policy on seed (production and distribution);

(iii) An assessment of the effects on the formal and informal seed sectors of targeting vs. non-targeting (for) the distribution of free seed by MAF - to inform the policy on seed; production and distribution; and

(iv) An assessment of the comparative impact of implementing the International Fund for Agriculture Development (IFAD) funded Timor-Leste Maize Storage Project (TLMSP) as currently planned (independent from MAF-SoL), compared with complementary collaboration with MAF-SoL in TLMPS's target districts.

This report presented here is on the third study.

[1] In this report staple food crops are defined as rice, maize, sweet potato and cassava (the latter considered to be roots and tubers).
[2] This example has been included because the conclusions from a recent appraisal of 10 such irrigation schemes (completed by the author – reference footnote 6) are directly relevant to the study Impact of Rice Imports on Rice Production in Timor-Leste Study.
[3] Mr. Philip Young.
[4] Note: the fourth study was not listed in the Consultant's Terms of Reference, but was completed as a matter of course because the information required was available from the first three studies, and from associated work completed by the Consultant on the International Fund for Agriculture Development's (IFAD's) Timor-Leste Maize Storage Project (TLMSP).
[5] The words in parentheses have been added to the Terms of Reference.

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Abbreviations and Acronyms

AusAID	Australian Agency for International Development
cif	Currency, Insurance and Freight
CSPG	Community Seed Production Group
EIRR	Economic Internal Rate of Return
FAO	Food and Agriculture Organization
FNSTF	Food and Nutrition Security Task Force – in MAF's National Directorate for Policy and Planning
FSS	Formal Seed Sector
IFAD	International Fund for Agriculture Development
ISS	Informal Seed Sector
MAF	Ministry of Agriculture and Fisheries
MAF-SoL	Ministry of Agriculture and Fisheries' Seeds of Life III Program
MCIE	Ministry of Commerce, Industry and Environment (previously MTCI)
MPS	Major Projects Secretariat (in Ministry of Finance)
Mt	Metric Tonne = 1,000 kg
MTCI	(former) Ministry of Tourism, Commerce and Industry
NDE	National Directorate of Statistics (in Ministry of Finance)
SDP	Strategic Development Plan
SoL	Seeds of Life
TAG	Technical Advisory Group – to MAF-SoL
TLMSP	IFAD's Timor-Leste Maize Storage Project
TLSLS	Timor-Leste Sustainable Livelihoods Survey

Executive Summary

Methodology

1. This Study required the preparation of complex models which reflect different combinations of seed sources and seed targeting, depending on which agency/ organization is responsible for seed sourcing/ production, and its distribution. These models enabled a comparison between net annual benefits flows to determine different impacts; and the comparison of the Net Present Values (at 30%) of differential net benefit flows to determine the opportunity costs of sub-optimal and inefficient practices, such as non-targeted seed distribution.

Conclusions

2. Incremental benefits from targeting seed distribution are very large. Modelling shows that the annual cost to Timor-Leste of persisting with the practice of not targeting seed distribution could be as high as $26.00 million per year, based on 50 Mt of seed. Even if Component 2 seed costs $30/kg, and is targeted, the NPV of incremental benefit flows is strongly positive at a discount rate of 60%, indicating a very acceptable rate of return from investment in MAF-SoL's Component 2.

Recommendations

3. The recommendations from the foregoing analyses are straight forward. These are: (i) focus on ensuring that MAF and all Development Partners and NGOs target (and support) their seed distribution activities; and (ii) continue to invest in Component 2 – perhaps after some rationalization to reflect the impact of successful CSPGs on seed supplies, the reduced need for breeder and foundation seed if farmers retain their own seed, and there is a system in place to support an SRR of about 30%.

1 Sources of Information and Data

4. The Consultant used information and data from many sources to undertake the various analyses required to complete the studies. These are referenced in the text, and as footnotes and notes to tables. The key sources of data and information which should be referenced at the beginning of this report are:

   (i) Published information on the demand for and supply rice in Timor-Leste (in the Strategic Development Plan [SDP] – Table 8, page 120); and revised demand for and supply of rice based on assumptions which are less optimistic than those used in the SDP given the results from the 2010 national census and MAF's inability to fulfil its SDP mandate, because of, amongst other reasons of severe budget limitations;

   (ii) Published statistics on rice imports (from MAF's FNSTF) - based on data from Customs and line ministries with an involvement in Timor-Leste's food and nutrition sector); and published data and statistics on rice imports from the National Department of Statistics (NDE) in the Ministry of Finance;

   (iii) MAF-SoL's Annual Research Reports which contain reliable and statistically valid data on staple crop yields, plus other internal MAF-SoL reports on topics such as Annual Seed Production and Distribution;

   (iv) MAF-SoL's Baseline Survey for Phase III;

   (v) Information and data collected from interviews with private rice traders – respecting the confidentially of their private business dealings;

   (vi) World Bank unpublished reports on Timor-Leste's stale food situation and various analytical policy papers prepared under the Global Food Response Program (GFRP) Technical Assistance, which ran from October 2011 to June 2012; and

   (vii) The unpublished analyses which underpinned the Consultant's recent work for the Major Projects Secretariat (MPS) within the Ministry of Finance (MoF) on Irrigation Economics[6].

[6] See "Final Appraisal Report: Appraisal of Seven Irrigation Schemes", October 2012.

2 Discussion of Issue and Background Information

2.1 Terms of Reference

5. The Terms of Reference for this study are: *"An assessment of the effects on the formal and informal seed sectors of targeting vs. non-targeting (for) the distribution of free seed by MAF - to inform the policy on seed (production and distribution)"*.

2.2 Introduction

6. This study focuses on the impact of free seed distribution by Government (MAF), FAO, NGO's etc., (using seed sourced from the formal sector - MAF-SoL's Component 2) on different segments of Timor-Leste's seed market. Consideration of the return on MAF-SoL's investment in formal seed production is also included in this study. The intention is to examine two issues in particular: (i) planning for formal seed production and attempting to minimise the production of expensive surplus seed from Component 2, which is currently given away free-of-charge; and (ii) targeting those segments of the seed market which are least likely to buy seed, so a surplus of formal seed doesn't "cannibalise" the informal seed market.

2.3 Understanding Timor-Leste's Agriculture Seed Industry

7. Timor-Leste's seed industry is complicated and "entangled" for a country which has about 150,000 households living outside Dili[7] - about 45,000 households grow rice and 95,000 households grow maize. If the seed industry was functioning efficiently with involvement of the private sector in the form of small-scale on-farm production of "grower-ready, certified as truthfully labelled seed" (as is currently supported by MAF-SoL's Component 3) the annual demand for seed would be about 750 Mt of maize and 450 Mt of rice – total of 1,200 Mt assuming a 33% SRR.

8. Simplistically, 1,200 Mt of seed could be grown on about 400 ha (assuming an average yield of 3Mt/ha) and would be valued in local markets at about $1.8 million ($1.50/kg)[8]. Such as system would need to be supported by a formal seed sector which is capable of producing about 20 Mt of stock seed and 0.5 Mt of foundation seed per annum[9]. The size of this theoretical market is very small when compared with the cost of importing seed (about $1.30 million for 290 Mt of maize seed alone in 2013) but unfortunately Timor-Leste's agriculture seed industry is not operating efficiently and its many players are implementing

[7] Source: 2010 National Census.
[8] In late 2012 Sele maize seed was being sold by CSPGs for $1.50/kg.
[9] Applying the ratios suggested by MAF-SoL's Formal Seed Production Advisor.

conflicting and inefficient seed distribution programs which are contributing to the general state of confusion, duplication and reduced impact. MAF-SoL has recognized this inefficient situation and commissioned studies on the effect of importing seed on the nations seed industry and this study.

9. The Consultant recognizes that MAF has drafted a National Seed Policy to guide the development of this vital aspect of agriculture production. However the seed industry may be breaking down with multiple programs (all with good intentions) attempting to provide Timor-Leste's farmers with free, good quality seed.

2.4 Main Seed Industry Players and Programs

10. Timor-Leste has many MAF- and Development Partner-supported seed import, production and distribution projects and programs. MAF-Sol has taken the lead through considerable investment in Components 1, 2 and 3, and is supported by most NGOs, FAO, the EU's Rural Development Programs, other bilateral projects, etc. MAF-SoL has managed to achieve some "order, logic and structure" in some sectors of the seed chain through good cooperation with NGOs and most Development Partners. This has been through targeted distribution of quality seed for use by CSPGs, and use of a record-keeping system which enables some impact analysis and quality control.

11. Unfortunately (and as outlined in the study Effect of Importing Maize and Rice Seed on Agricultural Production in Timor-Leste) MAF is "competing with itself" when it comes to implementing seed import and free distribution programs which are in direct conflict with the objectives of programs/projects which are embedded in the ministry. As concluded in the study Effect of Importing Maize and Rice Seed on Agricultural Production in Timor-Leste, "*on the one hand the ministry is importing and distributing expensive seed, and on the other the ministry is attempting to develop a sustainable domestic seed production industry*.

12. It is necessary to understand the current structure of Timor-Leste's agriculture seed industry if readers are to be able to follow the convoluted paths through which various types of maize (and rice) seed pass on the way to farmers' fields. The basic categorizations are the "formal" and "informal" seed sectors, and the two approaches to seed distribution to these sectors are "targeted" and "non-targeted". Figure 1 is a simplistic presentation of the linkages between the two sectors and their two targets.

13. Theoretically, if seed distribution is targeted it is reasonable to expect high returns from investment in seed production (1A, Figure 1), and the converse (2A). If seed is targeted or non-targeted the demand for seed remains about the same (1B and 2B) but much higher levels of staple food production would be expected if seed is targeted (1B) compared with non-targeted seed distribution (2B). This study is based on seed supply and food production models which reflect these targeting combinations and their impact on staple food production, plus an assessment of the returns from investing in formal seed production through Component 2.

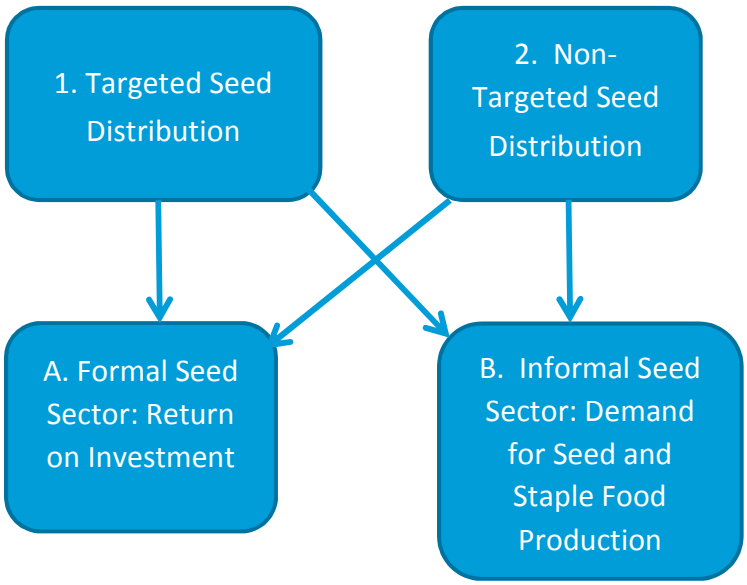

Figure 1: Simplistic Description of Timor-Leste's Agriculture Seed Industry

2.5 Seed Sources and Paths

14. Certified/ high quality maize and rice seed is currently sourced from: (i) overseas (imports - mainly from Indonesia for maize, and the Philippines for rice); and (ii) MAF-SoL's Component 2 (entitled "Formal Seed Production"). These two sources of seed are referred to as the Formal Seed Sector (FSS) and provide most of the seed which is handed-out free-of-charge by MAF, NGOs and Development Partners.

15. The Informal Seed Sector (IFS) encompasses the seed path which is "positioned below the FSS" and is generally considered to commence once seed reaches the farm level. This is why MAF-SoL's Component 3 is entitled "Informal Seed Production" - it focuses on CSPGs.

16. Specifically, the FSS produces seed which is used by:

    (i) MAF-SoL's Component 1 on research stations, and for OFDTs on farmer's fields (free seed, targeted);

    (ii) MAF-SoL's Component 2 itself, for bulking up and to maintain a secure supply of important varieties (free seed, targeted);

    (iii) MAF-SoL's Component 3 as the basis for its CSPGs program (free seed, targeted);

    (iv) INGOs and NNGOs who run (mainly) food security programs (partially targeted), and who also support MAF-SoL's Component 3 through outreach into non-MAF-SoL target areas (targeted) (usually seed purchased from/ supplied by MAF-SoL);

(v) MAF itself for free distribution to: (a) farmers who have not been able to save seed, or who have lost their seed (non-targeted), (b) agriculture high-schools and the University of Timor Lorosae (targeted), and (c) NNGOs and INGOs (targeted and non-targeted) (this seed was free from MAF-SoL, but now MAF is actually buying seed from MAF-SoL);

(vi) Other Development Partners' projects which focus on food security (seed purchased from MAF-SoL), (partially-targeted); and

(vii) FAO which either uses seed on their own food security projects (partially targeted), or donates seed to MAF for onward distribution as free seed (non-targeted) (seed purchased from MAF-SoL).

2.6 Other Relevant Points

17. The IFS produces seed which is retained by farmers for their own use and/ or for local sale. The key MAF-SoL activity in this sector is support for the development and operation of CSPGs which comprise small groups of farmers who grow MAF-SoL improved varieties and store seed for subsequent use (or local sale) in 200 L air-tight drums. By the end of 2013 MAF-SoL aims to have 1,000 CSPGs operating in all districts. MAF-SoL has formed valuable partnerships with NGOs and Development Partners who are functioning as out-reach partners and thereby increasing MAF-SoL's geographic coverage.

18. The IFS is "vulnerable to seed dumping" (mainly free seed hand-outs using imported and MAF-SoL produced seed, but also the same practice by NGOs, FAO and some Development Partners) as receipt of free seed acts as a disincentive for farmers to invest their labour and resources in securing their own seed supplies. As reported by MAF-SoL's advisors: *the distribution of large tonnages of free seed (There is no record of the tonnages handed-out in 2012) has a major impact on MAF-SoL's Component 3; and with better targeting directed at sustainable food production and seed security it should be possible to substantially reduce the tonnages of seed which need to be generated by MAF-SoL's Component 2 (see para 8).*

19. Furthermore when the cost of producing seed through MAF-SoL's Component 2 is amortized over the tonnage of seed produced by the CSPGs, the cost of the Component 2's "over-head" is substantially lower if farmers are producing the bulk of seed which is planted annually. However if Component 3 is "cannibalized" by the "dumping surplus seed" from Component 2, this "overhead" (a publically funded cost) is much higher. This is particularly the case if stock seed is only required every three years to replace contaminated varieties, or to introduce new varieties.

20. Therefore it seems illogical to over-produce expensive seed through Component 2 (the current situation) when this seed is generally "wasted" (in terms of its sustainable impact on food production) if it is handed out free-of-charge without

any follow-up support for recipients[10]. If it is not possible to track where the free seed has been distributed there is little chance that this seed will result in more than average crops for one or two.

21. "Community" seed produced by farmers under Component 3 is much cheaper than source seed (breeder, foundation or stock seed) from Component 2, and in a seed emergency it is very expensive to distribute source seed to needy farmers. However, there is at least a partial explanation of why MAF is not able to buy seed from farmers – Timor-Leste's procurement guidelines and rules prevent this practice despite its logic in terms of cost and impact. This does not mean that importing seed is necessarily any more efficient or cost-effective. The international seed procurement process is slow and cumbersome and often results in very delivery of (sometimes) suspect quality seed to farmers[11].

22. If poor quality imported seed fails (for example poor germination) there are no formal lines for complaints to the seed producers – farmers simply suffer in terms of reduced crop production. However if seed produced by CSPGs or contract commercial contract growers fail there is a "fall-back" position as peer pressure can be applied by buyers of the failed seed on farmer-members of the CSPGs. Such linkages are essential for the development of a mature seed industry but this will not emerge if MAF continues to hand-out free seed.

23. Another issue is that even if MAF purchased seed (for free hand-out) from CSPGs (who will soon be by far the largest seed producers in Timor-Leste) once this seed is distributed it becomes non-targeted and therefore it is impossible to track its impact or sustainability. Some of this free seed is often used for food and some is onward sold into local food and seed markets, and therefore disappears from the seed system.

24. Maize seed produced by commercial seed producers or CSPGs can be purchased by MAF for about $1.50/kg compared with $5.00/kg (farm-gate price) for imported seed. This means that the planned import of 290 Mt of maize seed in 2013 is equivalent to about 976 Mt of domestically produced Sele seed, in terms of direct costs. When yield and seed retention practice "differentials" are considered, the huge opportunity cost of MAF not purchasing and distributing its "own" Sele seed becomes apparent.

25. In a "perfect world" targeted seed distribution into seed production channels and farmer-based seed multiplication systems would be the most logical approach to supplying seed to Timor-Leste's maize and rice farmers. However many farmers still remember times when seed was in short supply or not available because of civil disturbances and/ or unfavourable seasons. This lingering scenario means that it is probably premature to suggest that Timor-Leste should completely abandoned the practice of public sector support to "guarantee" a supply of seed during emergencies.

26. An option worthy of consideration is more focussed and targeted distribution of free seed rather than simply handing out seed to any farmer who reports a seed

[10] See footnote **Error! Bookmark not defined.**.
[11] Anecdotal evidence from MAF and MAF-SoL staff.

deficiency at planting time. This approach would protect vulnerable rural communities during a seed crisis and preferably should be based on the use of seed stamps which can be cashed in at seed fairs, and with accredited seed merchants.

2.7 Linkages between Seed Sectors and Distribution Systems

27. Figure 1 (Section 2.4) can be expressed in tabular form to describe the linkages between Timor-Leste's seed sectors, and seed distribution systems and staple food production systems. The table can also be used as a framework for an assessment of efficiency in terms of direct and opportunity costs. Table 1 sets out these linkages and indicates the key analyses required to address the Terms of Reference. These are: (i) estimation of the financial and economic costs of seed from various sources so that the impact of this seed can be determined in terms of direct costs, and the opportunity cost of production foregone because of the distribution of free inferior varieties (compared with Sele as a "bench-mark"); and (ii) estimation of the returns from investing in formal seed production if seed distribution is targeted or non-targeted.

28. Table 1 shows just how complicated Timor-Leste's seed industry has become with multiple players having roles in "seed paths", and with some players involved in three levels of seed ownership. For example, MAF: (i) distributes imported seed directly; (ii) distributes seed purchased from itself (MAF-SoL); and (iii) distributes seed purchased by FAO from MAF-SoL, which is then granted to the ministry. There are obviously considerable inefficiencies in such a complicated system. These can be calculated by comparing the Net Present Values (NPV) of benefit flows (increased staple food production) which are generated from seed which is targeted and non-targeted. Such a process enabled the linkages in Figure 1 and Table 1 to be quantified and analysed in order to derive answers to the questions posed in para 27.

Table 1: Linkages between Seed Sectors, Seed Distribution systems and Final targets

Example for Sele Maize Seed Source	Primary Seed Owner a/	Secondary Seed Owner b/	Tertiary Seed Owner c/	Seed Target/ Model	Model No. d/	Targeted/Non-Targeted	Multiplier Effect e/	Multiplier f/	Links, Figure 3	NPV, Net Benefits ($ mill) g/
1. MAF-SoL Compt 2 (Sele)	**MAF-SoL**	**MAF**		**1. Farmers without sufficient seed**	**Model 1.1**	**Non-Targeted**	**None**	**2**	**2A, 2B**	**$71.55**
			NGOs	Farmers without sufficient seed		Non-Targeted	None	2		
				2. ISPGs (seed)	**Model 1.2**	**Targeted**	**Good**	**4**	**1A, 1B**	**$139.10**
				Food security projects		Partial Target	Good	3		
			Agric Schools	School farms		Targeted	Minimal	na		
			UNTL	Research/teaching		Targeted	Minimal	na		
		FAO	**MAF**	Farmers without sufficient seed		Non-Targeted	None	2		
				ISPGs (seed)	**Model 1.2**	**Targeted**	**Good**	**4**		
				Food security projects		Partial Target	Minimal	2		
		NGOs		Farmers without sufficient seed		Non-Targeted	None	2		
				ISPGs (seed)	**Model 1.2**	**Targeted**	**Good**	**4**		
				Food security projects		Partial Target	Good	3		
		ISPGs (MAF-SoL Cpt 3)		ISPGs (seed)	Model 1.2	Targeted	Good	4		
		MAF-SoL Compt 1		Adaptive research		Targeted	Minimal	na		
				OFTDS		Partial Target	Good	na		
		MAF-SoL Compt 2		Seed reserves		Targeted	None	na		

a/ The organization which first buys or produces seed.

b/ The organization which buys/ receives seed from the Primary Owner.

c/ The organization which buys/ receives seed from the Secondary Owner

d/ For reference in the text.

e/ Level of seed retention for following years.

f/ Scale of 1 -4 with 1 being no multiplier effect at all.

g/ 30% discount rate. Present Value of net benefit stream generated by distributed seed.

Green shade indicatates models included in analyses

na = not applicable.

2.8 Outline of Models Analyzed

29. Table 1 lists the models used to determine the cost and impact of various combinations of seed sources and seed targets. These are: (i) Model 1.1: Component 2 Seed, Non-Targeted Seed; and (ii) Model 1.2: Component 2 Seed, Targeted Seed.

30. This study used an adjusted Component 2 Cost Schedule from the SoL III Design Document to calculate the estimated operational and investment costs per kg of seed produced annually, and then applied an "overhead" multiplier to reflect a share of Program management and training costs. The figure comes to $5.50/kg seed assuming that 100 Mt of seed are produced annually, including a 50% "overhead" mark-up on operational and investment costs, plus the cost of supporting Component 3's CSPGs. To be conservative the analyses below used a figure of $10.00/kg of seed, or two times the cost of imported maize seed ($5.00/kg)[12].

31. A valid comparison between the models detailed in Table 1 must be based on the same tonnage of seed from each source. Therefore a figure of 50 Mt was used because: (i) MAF intends to import 270 Mt of maize seed in 2013; (ii) Component 2 can produce this quantity of seed; (iii) there are ample supplies of commercial Sele seed (1,000 CSPGs by 2013); and (iv) there is an even larger supply of non-commercial Sele seed - maybe as much as 5,325 Mt as 13% of maize growers in Timor-Leste are now growing this variety.

[12] Note: recent analysis of MAF-SoL's Component 2 seed costs by the Earth Institute (C Planicka, post graduate student) estimated a much lower cost of Sele seed ($2.36/kg) but this did not include returns on investment in plant and equipment, or a share of overall Program overheads.

3 Analysis

3.1 Methodology

32. This study required the preparation of complex models which reflect different combinations of seed sourced from Component 2 and seed targeting, depending on which agency/ organization is responsible for seed sourcing/ production, and its distribution. These models allowed a comparison between net annual benefits flows to determine different impacts; and the comparison of the Net Present Values (at 30%) of differential net benefit flows to determine the opportunity costs of sub-optimal and inefficient practices, such as non-targeted seed distribution.

33. Table 2 is an example of a comparison between two seed targets (farmers with insufficient seed [non-targeted, and CSPGs [targeted]) and estimated multiplier effects of farmer-retained seed; assuming that seed was sourced from MAF-SoL Component 2 for both models. As mentioned in para 5, this comparison does not include consideration of the sources of seed as the impacts of this variable were analyzed in the study Effect of Importing Maize and Rice Seed on Agricultural Production in Timor-Leste.

3.2 Targeted and Non-Targeted Seed

34. There is a large differential between the net benefit flows generated by 50 Mt of targeted and non-targeted seed - an average of $26.16 million per year over 10 years. Therefore failure to target (say 50 Mt of seed) is costing Timor-Leste about $26.00 million per year (undiscounted average net benefits for targeted and non-targeted seed, see rhs of Table 2). The NPV of this differential (at a 30% discount rate) is $67.56 million, reflecting the very high opportunity cost of not targeting valuable seed produced by MAF-SoL's Component 2.

3.3 Returns from Investment in Component 2 Seed

35. The models are resilient when it comes to returns from investing in Component 2 to produce seed. Table 3 shows the NPVs of the net benefit streams for two targeting models: (i) seed not targeted and therefore a low seed multiplier effect (estimated to be 2); and (ii) seed targeted and therefore a high multiplier effect (estimated to be 4) – for various seed costs and discount rates. When Component 2 seed is targeted the NPVs of the net benefit flows are positive for seed costs ranging from $10/kg to $30/kg, and for discount rates ranging from 30% to 60%) (Table 3). This means that the returns from investing in seed production under Component 2 are very high and confirm that Component 2 has a crucial role in MAF-SoL, provided its product (high quality seed) is carefully targeted by MAF, NGOs and all Development Partners.

Table 2: Example of comparison between two different Seed targets Models

Annual Flow of Economic Benefits, Targeted & Non-Targeted Seed		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Model 1.1: Seed Source Model 1, Seed Target Model 1: MAF-SoL Component 2 Seed and Non-Targeted Seed Distribution: Multiplier = 2												**1.1**
Seed produced by Comp 2 (Mt)	Year 1, 3, 5, 7, 9	50		50		50		50		50		250
	% of seed planted a/	70%										
	Seed Retention % b/	50%			NPV (30%) of NEV of Production ($ mill)--->				$71.55			
	Farmer Seed (Mt)	1,050										
Total ha planted for food, not seed			35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000
Yield (Mt/ha grain) - Sele		1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
Total maize production (Mt)			63,000	63,000	63,000	63,000	63,000	63,000	63,000	63,000	63,000	567,000
Storage losses (%)		25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%
Storage losses (Mt)		0	15,750	15,750	15,750	15,750	15,750	15,750	15,750	15,750	15,750	141,750
Net maize production (Mt)		0	47,250	47,250	47,250	47,250	47,250	47,250	47,250	47,250	47,250	425,250
Economic Value ($/kg) of net production c/		$0.66	$0.66	$0.66	$0.66	$0.66	$0.66	$0.66	$0.66	$0.66	$0.66	$0.66
Gross Economic Value of production ($ million)		$0.000	$31.185	$31.185	$31.185	$31.185	$31.185	$31.185	$31.185	$31.185	$31.185	$280.665
Economic cost of seed ($ million)	$10	$0.500	$0.000	$0.500	$0.000	$0.500	$0.000	$0.500	$0.000	$0.500	$0.000	$2.500
Net Economic Value (NEV) of production ($ million)		**-$0.500**	**$31.185**	**$30.685**	**$31.185**	**$30.685**	**$31.185**	**$30.685**	**$31.185**	**$30.685**	**$31.185**	**$278.165**
Model 1.2: Seed Source Model 1, Seed Target Model 2: MAF-SoL Component 2 Seed and Targeted Seed Distribution: Multiplier = 4												**1.2**
Seed produced by Comp 2 (Mt)	Year 1, 5, 9	50				50				50		150
	% of seed planted a/	90%										
	Seed Retention % b/	75%			NPV (30%) of NEV of Production ($ mill)--->				$139.10	Increment--->		$67.56
	Farmer Seed (Mt)	2,025										
Total ha planted for food, not seed			67,500	67,500	67,500	67,500	67,500	67,500	67,500	67,500	67,500	607,500
Yield (Mt/ha grain) - Sele		1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
Total maize production (Mt)			121,500	121,500	121,500	121,500	121,500	121,500	121,500	121,500	121,500	1,093,500
Storage losses (%)		25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%
Storage losses (Mt)		0	30,375	30,375	30,375	30,375	30,375	30,375	30,375	30,375	30,375	273,375
Net maize production (Mt)		0	91,125	91,125	91,125	91,125	91,125	91,125	91,125	91,125	91,125	820,125
Economic Value ($/kg) of net production c/		$0.66	$0.66	$0.66	$0.66	$0.66	$0.66	$0.66	$0.66	$0.66	$0.66	$0.66
Gross Economic Value of production ($ million)		$0.000	$60.143	$60.143	$60.143	$60.143	$60.143	$60.143	$60.143	$60.143	$60.143	$541.283
Economic cost of seed ($ million)	$10	$0.500	$0.000	$0.000	$0.000	$0.500	$0.000	$0.000	$0.000	$0.500	$0.000	$1.500
Net Economic Value (NEV) of production ($ million)		**-$0.500**	**$60.143**	**$60.143**	**$60.143**	**$59.643**	**$60.143**	**$60.143**	**$60.143**	**$59.643**	**$60.143**	**$539.783**
Incremental NEV ($ million)		**$0.000**	**$28.958**	**$29.458**	**$28.958**	**$28.958**	**$28.958**	**$29.458**	**$28.958**	**$28.958**	**$28.958**	**$261.618**
NPV (30%) Incremental NEC ($ mill ----------->	**$67.56**									**10-year "average" --->**		**$26.16**

Minor errors due to rounding.

a/ Assumes that more of the non-targeted seed is "lost/wasted".

b/ Assumes that less of the non-targeted seed is retained for subsequent years' planting.

c/ Using farm-gate import parity price for rice ($660/Mt) assuming direct substitution.

Table 3: NPVs for Net benefit Flows: Returns on Investment in Component 2

NPV of Net Benefit Stream ($ million)				
Model 1.2: Seed Targeted: ISPGs: High Multiplier				
Seed Costs a/	Discount Rate			
	30%	40%	50%	60%
$10	$139.10	$101.96	$77.69	$61.37
$15	$138.82	$101.49	$77.49	$61.19
$20	$138.54	$101.25	$77.28	$61.00
$25	$138.25	$101.01	$77.07	$60.82
$30	$137.97	$100.78	$76.87	$60.63

4 Conclusion and Recommendations

4.1 Conclusion

36. Incremental benefits from targeting seed distribution are very large. Modelling shows that the annual cost to Timor-Leste of persisting with the practice of not targeting seed distribution could be as high as $26.00 million per year, based on 50 Mt of seed. Even if Component 2 seed costs $30/kg, and is targeted, the NPV of incremental benefit flows is strongly positive at a discount rate of 60%, indicating a very acceptable rate of return from investment in MAF-SoL's Component 2.

4.2 Recommendations

37. The recommendations from the foregoing analyses are straight forward. These are: (i) focus on ensuring that MAF and all Development Partners and NGOs target (and support) their seed distribution activities; and (ii) continue to invest in Component 2 – perhaps after some rationalization to reflect the impact of successful CSPGs on seed supplies, the reduced need for breeder and foundation seed if farmers retain their own seed, and there is a system in place to support an SRR of about 30%.