

Inventory of Climate Smart Agriculture Technologies, Innovations and Management Practices for Cashewnut Value Chain



Compiled by:

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DISCLAIMER

The information presented in this inventory of Technologies, Innovations and Management Practices (TIMPs) book is for advisory use only. Users of this book should verify site-specific details that relate to their agro-climatic zones from their area agricultural extension officers.

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FOREWORD

The Kenya Agricultural and Livestock Research Organization (KALRO) through the support of development partners has laid a strong foundation for growth and commercialization of agriculture in Kenya. This has been done through the development of Climate Smart Technologies, Innovations and Management Practices (TIMPs) through the adaptive and applied research guided by some of the research gaps identified earlier. In addition, the organization has embraced an interconnected information communication technology to ease the handling of data and information from research. A notable inclusion is the use of the Big Data Platform to integrate digital information from value chains. The National Agricultural Value Chain Development Project (NAVCDP) seeks to build on and deepen investments into interventions on productivity enhancement, community-led farmer extension, water management investments and data-driven value chain services from KCSAP and NARIGP previous projects. In this NAVCDP project, KALRO seeks to strengthen, customize and update the existing inventories of TIMPs, with emphasis on climate resilience, safer food production practices, value addition, nutrition, market participation and commercialization.

With the continued support, KALRO also is poised to continue providing quality technical assistance for value chain development at all levels and build capacity of county level implementation units to anchor project activities. With the support of NAVCDP, KALRO has developed inventories of TIMPs for the two new value chains, pyrethrum and rice and is continuously expanding, updating and revising existing inventories of TIMPs. In doing so, KALRO further strengthens climate resilience, value addition and market participation aspects of the updated TIMPs to support farmers to transition from subsistence to commercial farming. The organization continues to support the strengthening of the current Big Data platform at KALRO as the foundational database for insightdriven, more productive, resource efficient and climate-resilient farming. To enhance the effective coordination of research linkages and agriculture digitization, KALRO and the Ministry of Agriculture and Livestock Development have put in relevant support mechanisms to oversee the implementation of these activities.

Extensive information from research and background data has been used to develop this revised Inventory of TIMPs for the Cashew Value chain. To disseminate the TIMPs, a Training of Trainers (ToT) manual has been developed. The design of the manual takes into consideration the delivery system, partners and their roles, duration of training and logical flow of the modules. The training modules have a uniform outline that ensures every aspect of the TIMPs are fully covered in way that the trainees can absorb and relate to. Various delivery methods are deployed and where possible demonstrations and practical work are incorporated to enable the trainees learn by participating in the actual field activities. The use of this TIMPs inventory is expected to contribute to the achievement of the Project Development Objective (PDO), which is to increase market participation and value addition for targeted farmers in select value chains in project areas. This revised TIMPs inventory is to be used in conjunction with the respective ToT Manual.

Finally, I am greatly indebted to the value chain leaders and all those who participated in the preparation and revision of this Inventory of TIMPs for the Cashew Value Chain. It is expected to herald new ways of delivering training content that will enable realization of the project objectives and aspirations.

Eliud K. Kireger, PhD, OGW **Director General, KALRO**

PREFACE

The National Agricultural Value Chain Development Project (NAVCDP) is a Government of Kenya project with support from the World Bank. The five-year project is being implemented in 34 counties clustered in seven regions at an approximate cost of U\$ 275 million. The project development objective (PDO) is "increase market participation and value addition for targeted farmers in select value chains in project areas." It is expected that this objective will be achieved through implementing the five project components, namely; Building Producer capacity for climate resilient stronger value chains; Climate Smart Value Chain Ecosystem Investments; Piloting Climate Smart Safer Urban Food Systems; Project Coordination and Management; and Contingent Emergency Response Component.

The National Agricultural Value Chain Development Project aims to support 3.8 million small-scale farmers transitioning from subsistence to commercial farming, or are selling only a small percentage of their produce commercially. Additional beneficiaries of the Project include value chain actors at various levels, the extension workers, aggregators, logistics support providers and SMEs operating within the value chain. The Project places a strong focus on inclusion of women farmers within the supported Value Chains (VCs). Thirteen VC's have been selected based on a thorough qualitative and quantitative assessment of their potential. The selected VCs based on their ranking are Dairy, Chicken, Coffee, Avocado, Banana, Mango, Irish potatoes, Tomato, Apiculture, Pyrethrum, Cashew nut, Cotton and Rice. Additional value chains prioritized by counties will be supported by their respective County Project Coordination Units.

The National Agricultural Value Chain Development Project has partnered with KALRO to continue strengthening and expanding the existing inventory of TIMPs with an emphasis on climate resilience, value addition, nutrition, and safer food production practices. Through this partnership, KALRO has developed Technologies, Innovations and Management Practices (TIMPs) inventories for the two new value chains - Rice and Pyrethrum, and revised existing inventories of TIMPs for all other value chains developed during the implementation of KCSAP and NARIGP. It also supports the strengthening of the existing Big Data platform at KALRO as the foundational database for insight-driven, more productive, resource-efficient and climate-resilient farming. Finally, the Ministry of Agriculture, Livestock Development (MoALD) has put in place relevant support mechanisms with KALRO to oversee effective implementation, coordination of research linkages and agriculture digitization.

In developing suitable inventories of TIMPs and corresponding ToT manuals, KALRO has leveraged information resources as well as those of its partners and collaborators. Use of these information resources, coupled with the accompanying training and contribution of the other project components, will go a long way in enabling NAVCDP to meet its development objectives.

The National Project Coordination Unit is grateful to all who participated in the development and production of this revised Inventory of TIMPs for Cashew Value Chain. It is my hope that counties and other users will put this resource to good use as they transform and reorient their agricultural systems to make them more productive and resilient while minimizing GHG emissions under the new realities of the changing climate.

Samuel Guto, PhD National Project Coordinator National Agricultural Value Chain Development Project

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ABBREVIATIONS AND ACRONYMS

AEZ	Agro-ecological zone
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ASALs Arid and Semi-Arid Lands

1.0 INTRODUCTION

1.1 Background Information

The Kenya Climate Smart Agriculture Project (KCSAP) is a Government of Kenya/World Bank supported project under the State Department for Crops Development in the Ministry of Agriculture and Livestock Development (MoALD). The Project Development Objective (PDO) is "to increase agricultural productivity and build resilience to climate change risks in targeted smallholder farming and pastoral communities in Kenya, and in the event of an Eligible Crisis or Emergency, to provide immediate and effective response". This objective will be achieved through utilization of climate-smart agriculture (CSA) technologies, innovations and management practices (TIMPs). Cashew TIMPs are the best for adaptation to achieve food security under a changing climate while delivering co-benefits for environmental sustainability, nutrition and livelihoods.

The KCSAP Project aims to inventorise all CSA TIMPs in the Cashew Value Chain. The overall goal is three pronged: (1) Improve efficiency in the use of land resources to produce cashew; (2) Maintain the resilience of cashew production systems and the dependent communities; and (3) Gain an understanding on how to reduce the vulnerability of communities negatively impacted by climate change in Kenya.

1.2 Definition of Terms for Technologies, Innovations and Management Practices

Agripreneur: An established commercial agri-entrepreneur who will be mentored and coached by a business accelerator to deliver E-extension sustainably and provide digital data on TIMPS dissemination and adoption.

Technology: Is an output of a research process which is beneficial to the target clientele (mainly farmers in our case). Technology can be commercialized and can be patented under intellectual property rights (IPR) arrangements. **Examples** include research outputs such as improved varieties among others.

Innovation: Is a modification of existing technology for an entirely different use from the original intended use. It is also an application of new or existing knowledge/technology in a new way or context to do something better or different. **An example** is a new cashew product that has not been locally explored before

Management practice

Management practices, frequently called best management practices (BMPs), are tools that farmers can use to reduce soil and fertilizer runoff, properly manage animal waste, and protect water and air quality on their farms while achieving multiple positive environmental outcomes. These tools often improve a farmer's bottom-line by reducing operating costs. In aquaculture, practices considered to be the most practical and effective means of achieving a resource management goal, or to prevent one or more negative environmental impacts are called BMPs. Usually a single BMP will not solve a problem, and several BMPs may be used. The term BMP only is intended to imply that the practice is the best way currently known for preventing the negative outcome. As technology advances, BMPs may be revised. The resulting recommendations are classified as management practices since they enlighten the target clientele in the area on a certain best practice(s).

1.3 Summary of Inventory of TIMPs in the Cashew Value Chain

The inventory process resulted in a total of 90 Cashew TIMPs including 44 technologies, 5 innovations and 41 management practices distributed among the 11 sub-themes, as indicated in Table 1. Table 1: Summary of Cashew TIMPs

Commodity/VC	Sub-Theme	Technologies	Innovations	Management Practices
Cashew	Improved cashew varieties	14	0	0
Cashew	Cashew seed system	2	0	0
Cashew	Agronomic management	2	0	2
Cashew	Soil Fertility Management	0	0	3
Cashew	Soil and Water Management	2	1	10
Cashew	Cashew Crop health	3	1	10
Cashew	Harvesting and Postharvest management	4	0	3
Cashew	Cashew Value addition	6	3	0
Cashew	Food safety management system	0	0	2
Cashew	Mechanization of Cashew production activities	11	0	0
Cashew	Cashew business and Marketing	0	0	7
Cashew	Agricultural Policy Options	0	0	4
Overall Total	90	44	5	41

1.4 Summary of Status of TIMPs in Cashew Value Chain

The inventory process resulted in a total of 53 TIMPs that are ready for up-scaling, 35 TIMPs that require validation and 2 TIMPs that require further research in the sub-themes, as indicated in Table 2.

Table 2: Number of TIMPs ready for up-scaling, require validation or further research

Commodity/VC	Sub-Theme	Ready for up- scaling	Require validation	Further Research
Cashew	Improved Cashew varieties	10	4	0
Cashew	Cashew seed system	2	0	0
Cashew	Agronomic management practices	4	0	0
Cashew	Soil Fertility Management	3	0	0
Cashew	Soil and Water Management	13	0	0
Cashew	Cashew Crop health	6	8	0
Cashew	Harvesting and Postharvest management	1	6	0
Cashew	Cashew Value addition	1	8	0
Cashew	Food Safety Management System	2	0	0
Cashew	Mechanization of Cashew production	6	3	2

	activities			
Cashew	Cashew business and marketing	5	2	0
Cashew	Agricultural Policy Options	0	4	0
Overall Total	90	53'	35	2

1.4 Summary of Status of TIMPs in Cashew Value Chain

The inventory process resulted in a total of 40 TIMPs ready for upscaling, 36 require validation and 1 requires further research in the sub-themes, as indicated in Table 3.

Table 3: Inventory of Cashew TIMPs, Category, and Status of TIMPs readiness

TIMPs Sub-	TIMPs Title	TIMPs	Status
Theme		Category	
2.2 Improved	2.2.1 Improved Cashew	Technology	Ready for upscaling
Cashew	variety KKorosho 75		
varieties	2.2.2 Improved Cashew	Technology	Ready for upscaling
	variety KKorosho 100		
	2.2.3 Improved Cashew	Technology	Ready for upscaling
	variety KKorosho 81		
	2.2.4 Improved Cashew	Technology	Ready for upscaling
	variety KKorosho 82		
	2.2.5 Improved Cashew	Technology	Requires validation
	variety A90		
	2.2.6 Improved Cashew	Technology	Requires validation
	variety A41		
	2.2.7 Improved Cashew	Technology	Requires validation
	variety JK 90		
	2.2.8 Improved Cashew	Technology	Requires validation
	variety JK460		
	2.2.9 Improved Cashew	Technology	Ready for upscaling
	variety JK228		
	2.2.10 Improved Cashew	Technology	Ready for upscaling
	variety JK292		
	2.2.11 Improved Cashew	Technology	Ready for upscaling
	variety T83		
	2.2.12 Improved Cashew	Technology	Ready for upscaling
	variety A47		
	2.2.13 Improved Cashew	Technology	Ready for upscaling
	variety JK411		
	2.2.14 Improved Cashew	Technology	Ready for upscaling
	variety MT10		
2.3 Cashew	2.3.1 Cashew propagation through	Technology	Ready for upscaling
seed system	wedge grafting		
	2.3.2 Raising cashew rootstock for	Technology	Ready for upscaling
	grafting		
2.4 Agronomic	2.4.1 Cashew spacing	Management	Ready for upscaling
management	Recommendation	Practice	
practices	2.4.2 Cashew pruning	Management	Ready for upscaling
-		Practice	

	2.4.3 Cashew coppicing	Technology	Ready for upscaling
	2.4.4 Cashew top-working	Technology	Ready for upscaling
2.5 Soil	2.5.1 Integrated manure management	Management	Ready for upscaling
fertility		practice	
management	2.5.2 Integrated soil fertility management	Technology	Ready for upscaling
	2.5.3 Rapid soil testing	Management practice	Ready for upscaling
2.6 Soil and	2.6.1 Contour bands	Technology	Ready for upscaling
water	2.6.2 Zai Pits	Technology	Ready for upscaling
management	2.6.3 Bench Terraces	Technology	Ready for upscaling
munugement	2.6.4 Fanya Juu Terraces	Technology	Ready for upscaling
	2.6.5 Stone lines	Technology	Ready for upscaling
	2.6.6 Retention ditches	Management	Ready for upscaling
		practice	
	2.6.7 Grass strips	Management practice	Ready for upscaling
	2.6.8 Tied ridges/Ridging/Earthing	Management practice	Ready for upscaling
	2.6.9 Rain water harvesting	Management	Ready for upscaling
	System (Roof catchment)	practice	
	2.6.10 Conservation agriculture (CA)	Innovation	Ready for upscaling
	2.6.11 Cashew/Legume	Technology	Ready for upscaling
	Intercropping	Tashaalaay	Deedy for unceeling
	2.6.12 Mulching	Technology	Ready for upscaling
	small scale farmers	Technology	Ready for upscaling
2.7 Cashew	2.7.1 Integrated Management of	Management	Ready for upscaling
Crop Health	cashew powdery mildew	practice	
	(Oidium anacardii F. Noack)		
	disease in cashew		
	2.7.2 Integrated Management of	Management	Ready for upscaling
	anthracnose (Colletotrichum	practice	
	gloesporioides) disease in		
	cashew		
	2.7.3 Integrated management of	Management	Requires validation
	Helopeltis bugs in cashew	practice	
	2.7.4 Integrated management of	Management	Requires validation
	(Deconut (Coreid)Bug	practice	
	(Pseudoinerapius wayi) III		
	2.7.5 Integrated management of	Managamant	Poquires validation
	Cashew weevil (Macocorpus lorings)	practice	Requires vanuation
	in cashew	practice	
	2.7.6 Integrated management of Red	Managamant	Requires validation
	handed thrins (Selenothrins	practice	Requires vanuation
	<i>rubrocinctus</i>) in cashew	practice	
	2.7.7 Integrated management of	Management	Requires validation
	Mealybugs (<i>Pseudococcus</i>	practice	
	longispinus) in cashew	rinence	

	2.7.8 Integrated management of	Management	Requires validation
	Cashew stem girdler (Paranaleptes	practice	
	reticulata)	-	
	2.7.9 Integrated Weed Management in	Management	Ready for upscaling
	cashew orchards	practice	
	2.7.10 Cover cropping for cashew	Innovation	Requires validation
	2.7.11 Mulching forweed control in	Technology	Ready for upscaling
	cashew	reennorogy	recurs for apscaling
	2.7.12 Chemical weed control in cashew	Technology	Ready for upscaling
	2.7.13 Mechanical weeding in cashew	Technology	Ready for upscaling
	2.7.14 Safe use of	Management	Requires validation
	Agrochemicals	Practice	
2.8 Harvesting	2.8.1 Timely Harvesting and Handling	Management	Requires validation
and	of cashewnuts	Practice	
Postharvest	2.8.2 Cashew sorting and	Management	Ready for upscaling
management	grading	Practice	
	2.8.3 Cleaning and sorting	Management	Requires validation
	2.8.4 Drying of Cashayy kernals	Technology	Pequires validation
	2.8.4 Drying of Cashew Kerners	Technology	Requires validation
	2.8.5 Jule sacks and Cashew hut stores	rechnology	Requires vandation
	2.8.6 Zero energy cooler	Technology	Requires validation
	2.8.7 Modified atmosphere packaging	Technology	Requires validation
2.9 Cashew	2.9.1 Cashew nut processing	Innovation	Ready for upscaling
Value	through drum roasting		
Addition	2.9.2 Roasted Cashew nut	Technology	Requires validation
	2.9.3 Cashew nut butter	Technology	Requires validation
	2.9.4 Cashew nut toffee	Technology	Requires validation
	2.9.5 Cashew juice	Technology	Requires validation
	2.9.6 Cashew apple jam	Technology	Requires validation
	2.9.7 Cashew wine	Technology	Requires validation
	2.9.8 Cashew apple flour	Innovation	Requires validation
	2.9.9 Processing of cashew apple into pulp	Innovation	Requires validation
2.10 Food	2.10.5 Good Agricultural	Management	Ready for upscaling
Safety	Practices (GAP) for	practice	
Management	Cashew		
System	2.10.4 Hazard Analysis Critical	Management	Ready for upscaling
v	Control Points (HACCP) Plan	practice	
	for Cashew Value		
	Chain in Kenya		
2.11	2.11.1 Power Tiller	Technology,	Ready for upscaling
Mechanization	2.11.2 Wheeled tractor	Technology	Ready for upscaling
of Cashew	2.11.3 Mouldboard plough	Technology	Ready for upscaling
production	3.11.4 Disk harrow	Technology	Ready for upscaling
activities	2.11.5 Hole drill	Technology	Ready for upscaling
	2.11.6 Backpack weeder	Technology	Ready for upscaling

	2.11.7 Motorized sprayer	Technology	Requires validation
	2.11.8 Power tree pruner	Technology	Requires further research
	2.11.9 Grafting robot	Technology	Requires validation
	2.11.10 Grafting tool	Technology	Requires validations
	2.11.11 Harvesting Machine	Technology	Further research
2.12 Cashew	2.12.1 Building a business plan	Management	Requires validation
Business and		practice	
marketing	2.12.2 Collective marketing	Management	Requires validation
		practice	
	2.12.3 Profitability analysis	Management	Ready for upscaling
		practice	
	2.12.4 Market research	Management	Ready for upscaling
		practice	
	2.12.5 Contracted production model	Management	Ready for upscaling
	-	practice	
	2.12.6 Marketing innovation model	Management	Ready for upscaling
		practice	
	2.12.7 Internet/mobile marketing	Management	Ready for upscaling
		practice	
2.13	2.13.1 National Agricultural Policy	Management	Requires validation
	strategy framework	practice	1
	2.13.2 County integrated development	Management	Requires validation
	planning	practice	D 111.
	2.13.5 Instruments of policy related to	practice	Requires validation
	2 13 4 Policy cycle	Management	Pequires validation
		practice	Requires vanuarion
	Total TIMPs	· ·	90

2.0 DETAILED CASHEW NUT VALUE CHAIN TIMPS

2.1 SUITABILITY MAPS FOR CASHEW NUT PRODUCTION IN KENYA



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2.2 IMPROVED CASHEW VARIETIES

2.2.1 Variety KKorosho75

TIMP Name	Variety KKorosho75	
	Red rounded Cashew Developing cashew fruit	
Category (technology	Technology	
innovation or management	recimology	
practice)		
A: Description of the technology,	innovation or management practice	
Problem to be addressed	Decline in cashew production due to use of aged tree and	
	overreliace	
	on low yielding cashew varieties with poor kernel quality and	
	long maturity period.	
What is it? (TIMP description)	A cashew variety with the following traits:	
	It is Suitable in altitude of 10-1000m in agro-ecological zones of	
	L2-L5, LM3-LM5 in Kwale, Mombasa, Kilifi, Tana River, Lamu,	
	Taita Taveta, Kitui, Makueni, Tharaka Nithi (LM4) Homa Bay	
	(LM4), Kisumu (LM4), Siaya (LM4) and Busia (LM4). The variety	
	nas yields of 4.9 l/na (70 kg per tree, per year at 5 years) and high	
	and kernel weight (5g). Medium plant height 015.4 m at 5 years old. The	
	cashew has a red and rounded apple. Secondary flowering and	
	prolonged production duration of up to 6 months	
Institution	A high vielding variety suitable in major cashew growing areas.	
	with high quality kernels and short maturity duration.	
B: Assessment of dissemination a	nd scaling up/out approaches	
Users of TIMP	Farmers, Breeders, Agripreneurs, Extension agencies, Nursery	
	operators, Traders, Nut s, and fruit processors and Consumers	
Approaches used in dissemination	• Farmer Field and Business School (FFBS)	
	Agricultural innovation platforms (AIP)	
	• Demonstrations – On-farm and on station	
	Agricultural shows/exhibitions/field days	
	• Trainings - workshops/Seminars/Meetings	
	Public and private Extension Agents	
	Farmer to farmer extension models	
	• Mass media – Electronic and print	
	Publications - posters/brochures/leaflets_manuals	
	• Publications - posters/brochures/leaflets, manuals	

	• Digital platforms – Website, Dashboards, Apps, social media
	short message services
Critical/essential factors for	Participatory Implementation
successful promotion	• Stakeholder capacity building
	• Functioning nurseries in close proximity to farmers
	Stakeholder networks
Partners/stakeholders for scaling	• MoALD - Extension services and regulation of on farm
up and their respective roles.	demonstration
	 KEPHIS - Phytosanitary regulation and patenting of materials
	• NGOs including FA(Farm Africa, Ten Senses Africa) and
	CBOs - Seedlings multiplication and technology
	• Farmer Groups – Adopt varieties
	 Service provider agencies including micro-finance agencies such as MESPT and banks – Provide loans to suppliers and producers
	• Agro- vets - supply agrichemicals to farmers
	• Aggregators establishment of nurseries and supply of
	planting materials to farmers
	• Nut Processors Association - Processors and manufacturers
C: Current situation and future s	caling up
Counties where already promoted,	Kilifi, Kwale, Tana River, Lamu, Mombasa and Tharaka Nithi
if any	
Counties where TIMPs will be	To be validated in: Taita Taveta, Kitui, Makueni, Tharaka Nithi,
up-scaled	Homa Bay, Kisumu, Siaya and Busia.
	To be up-scaled in Lamu, Kilifi and Kwale Counties
Challenges in development and	• Low interest in cashewnut production
dissemination	• Limited investment in the crop
	• Limited publicity
	• Few functional local processing facilities
Constructions for a dilucation data	Low investment in research
challenges	• Investment in crop development (research,
chanenges	• Strengthening asshow former organizations
	 Supportive policies such as subsidization of
	• Supportive policies such as subsidization of processing equipment and production inputs lifting of ban
	on export of raw nuts to stimulate competition
Lessons learnt in up scaling, if any	Involvement of private nursery operators, other government
Lessons realite in up sealing, it any	agencies (County, KEPHIS and MoALD-AFA), Non-governmental
	agencies (Tens senses) and MESPT has fast tracked the up scaling
Social environmental policy and	of the technology.
market conditions necessary for	Connect inclusiveness in crop research and development Connective huilding of statisheddars
development and up-scaling	Capacity building of stakeholders Linderstanding the physical and histic anyiranment in target
development and up-seaming	 Onderstanding the physical and blotic environment in target ecologies
	• Understanding community culture, preferences, and
	practices

D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations		
Basic costs per acre at 5 years	Approximate cost of production per acre; KES 8,257	
Estimated returns per acre at 5 years	Gross Margin of KES 33,610	
Gender issues and concerns in development, dissemination, adoption and scaling up	 Women and youth have limited access to productive resources such as land, credit, and quality seeds. Women and youth have limited access to education, training and extension services. Cashew trees are considered men's enterprises thereby limiting women control and benefit from 	
	 Men dominate decisions on cashew at the household and community Women perform most of the weeding and processing activities 	
Gender related opportunities	Opportunities for women exists in the node of nursery establishment where they can operate them as business enterprises	
VMG issues and concerns in development, dissemination, adoption and scaling up VMG related opportunities	 VMGs have limited access to productive resources such as land, credit, and quality seedlings VMGs have limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities VMGs have limited access to seed and information on new varieties and production techniques There is low adoption by VMGs due lack of awareness VMGs have opportunities in seed sorting, potting and grafting, cottage processing and marketing. Affirmative action opportunities such as the women and youth enterprise fund exists for VMGs to access the required credit. 	
E: Case studies/profiles of success	stories	
Success stories	 Increased uptake of KALRO cashew grafted seedlings of the new variety in Kilifi, Lamu and Tharaka Nithi Counties Technology adoption among private players and NGOs is increasing Individual farmers who have planted the variety and plantations 	
Application guidelines for users	 Cashew planting guide, KALRO Mtwapa Cashew for Cash booklet, KALRO Mtwapa KALRO Cashew Nut <u>https://play.google.com/store/apps/details?id=com.andromo.de</u> v724321.app928007 Cashew Nut Production, A reference handbook for farmers in Kenya, F.K. Muniu, KALRO; Email: directorgeneral@kalro.org Website: www.kalro.org Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima Nchini 	

	Kenya, Muniu F.K., KALRO Barua Pepe:
	directorgeneral@kalro.org Tovuti: www.kalro.org
F: Status of TIMP Readiness (1.	1. Ready for up scaling
Ready for up scaling; 2. Requires	
validation 3. Requires further	
research)	
G: Contacts	
Contacts	The Institute Director
	KALRO –ICRI Mtwapa
	<u>kalro.mtwapa@kalro.org</u>
Lead organization and scientists	KALRO, Mtwapa: Muniu F.K., Menza M., Mwashumbe S.,
	Pole F.
Partner organizations and contacts	1. Pwani University: info@pu.ac.ke, W. Mbinda
	2. KEPHIS: kephisinfo@kephis.org, T. Kosium
	3. AFA: info@afa.go.ke; T. Yawa

- 1. Evaluation of tolerance to cashew powdery mildew
- 2. Validation of kernel weight and kernel processing characteristics
- 3. Cost benefit analysis Areas for further research
- 4. Nutritional characteristics of the cashew apple
- 5. Processing of the cashew apple
- 6. Validation of technology in new growing areas

2.2.3 Cashew Variety KKorosho 100

TIMP Name	Cashew Variety KKorosho 100
Category (technology, innovation or management practice)	Technology
A: Description of the technology,	innovation or management practice
Problem to be addressed	Decline in cashew production due to use of aged tree and overreliance on low yielding cashew varieties with poor kernel quality and long maturity
What is it? (TIMP description)	A cashew variety with the following traits: Suitable in altitude of 10-1000m in agro-ecological zones, L2 lowland Marginal Sugarcane zone; L3 Coconut Cassava zone; L4

Justification B: Assessment of dissemination a	Cashewnut Cassava Zone; L5 Lowland Livestock Millet zone; LM5 Lower Midland Livestock Millet Zone; LM4 Marginal Cotton Zone; LM5 Livestock Millet Zone; LM3 Cotton Zone. Sites: Kwale, Mombasa, Kilifi, Tana River, Lamu, Taita Taveta, Kitui, Makueni, Tharaka Nithi, Homa Bay (LM4), Kisumu (LM4), Siaya (LM4) and Busia (LM4). The variety has yields of 4.2t/ha (60 kg per tree per year) at 5 years and has high nut and kernel weight of5g. Medium plant height (5.4 m at 5 years old. The variety has a spreading canopy tree habit with canopy width of 7.9 m at 5 years old It also has orange and angular apples. A high yielding variety suitable in major cashew growing areas and with high quality kernels and short maturity duration.
D. Assessment of dissemination a	Earmore broaders extension agencies Agripropuers Nursery
Users of Thyp	operators, Traders, Nut processors and fruit processors and consumers
Approaches used in dissemination	 Farmer Field and Business School (FFBS) Agricultural innovation platforms (AIP) Demonstrations - On-farm and on station Agricultural shows/exhibitions/field days Trainings - workshops/Seminars/Meetings Public and private Extension Agents Farmer to farmer extension models Mass media – Electronic and print Publications -posters/brochures/leaflets, manuals Digital Platforms– Website, Dashboards, Apps, social media short message services
Critical/essential factors for	Participatory Implementation
successful promotion	Stakeholder capacity building
	 Functioning nurseries in close to farmers Stakeholder networks
Partners/stakeholders for scaling up and their respective roles.	 MoALD, - extension services and regulation of on farm demonstration KEPHIS – phytosanitary regulation and patenting of materials NGOs and CBOs including FA (Farm Africa) Ten Senses Africa - Seedlings multiplication and technology dissemination Farmer Groups - Adapt varieties Service provider agencies including micro-finance agencies such as MESPT and banks - provide loans to suppliers and producers Agro-vets - supply agrichemicals to farmers Nut Processors Association of Kenya (NutPak – processors and manufacturers Aggregators - establishment of nurseries and supply of planting materials to farmers
Counties where already promoted.	Kilifi, Kwale, Tana River, Lamu
if any	

Counting where TIMDs will be		
Counties where Thypes will be	• To be up-scaled in Lamu, Kilifi and Kwale Counties	
upscaled	• To be validated in Taita Taveta, Kitui, Makueni, Tharaka	
	Nithi, Homa Bay, Kisumu, Siaya and Busia.	
Challenges in development and	• Low interest in cashewnut production	
dissemination	• Limited investment in the crop	
	• Limited publicity	
	• Few functional local processing facilities	
	• Low investment in research	
Suggestions for addressing the	• Investment in crop development (research,	
challenges	extension, and processing).	
	• Strengthening cashew farmer organizations.	
	• Supportive policies such as subsidization of	
	processing equipment and production inputs, and ban on	
	export of raw nuts	
	Campaign for attitude change	
Lessons learned in up scaling if	Involvement of private pursery operators other government	
any	agencies (County KEPHIS and MoAI D-AFA) Non-	
ary	governmental agencies (Ten sences) and MESPT has fast tracked	
	the up scaling of the technology	
Social environmental policy and	• Gender inclusiveness in crop research and development	
market conditions necessary for	 Gender merusiveness in crop research and development Capacity building of stakabaldars 	
development and up scaling	 Understanding the physical and biotic environment in target 	
development and up-scamig	• Orderstanding the physical and blotte environment in target	
	• Understanding community culture preferences and	
	• Onderstanding community culture, preferences, and	
D. Economic gender vulnerable	and marginalized groups (VMGs) considerations	
Basic costs	Approximately KFS 8 257 per acre	
Estimated returns	Gross Margin KES 30 600	
Gender issues and concerns in	Woman and youth have limited access to productive	
development dissemination	• Women and youth have infined access to productive	
adoption and scaling up	resources such as land, credit, and quality seeds.	
adoption and scaling up	• women and youth have limited access to education,	
	training and extension services.	
	• Cashew trees are considered men's enterprises	
	thereby limiting women control and benefit from	
	them.	
	• Men dominate decisions on cashew at the household	
	• Woman perform most of the weading and processing	
	activities.	
Gender related opportunities	• Opportunities for women exists in the node of nursery	
	establishment where they can operate them as business	
	enterprises.	

VMG issues and concerns in	• VMGs have limited access to productive resources such
development, dissemination,	as land, credit, and quality seeds
adoption and scaling up	• VMGs have limited access to training and extension
	services
	• Due to their social status VMGs are often excluded
	from decision making in development and
	dissemination activities
	• VMGs have limited access to seed and information on
	new varieties and production techniques
	• There is low adoption by VMGs due lack of awareness
VMG related opportunities	• VMGs have opportunities in seed sorting, potting and
	gratting, cottage processing and marketing.
	• Affirmative action opportunities such as the women
	the required credit
E: Case studies/profiles of success	stories
Success stories	• Increased uptake of KALRO cashew grafted seedlings of the
	new variety
	• Technology adoption among private players and NGOs is
	increasing
	• Individual farmers who have planted the variety and
	plantations
Application guidelines for users	1. Cashew planting guide, KALRO Mtwapa
	2. Cashew for Cash booklet, KALRO Mtwapa
	3. KALRO Cashew Nut
	https://play.google.com/store/apps/details?id=com.andromo
	<u>.dev724321.app928007</u>
	4. Cashew Nut Production, A reference handbook for farmers
	in Kenya, Muniu F.K. KALRO Email:
	directorgeneral@kalro.org Website: www.kalro.org
	5. Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima
	Nchini Kenya, F.K. Muniu KALRO Barua Pepe:
	directorgeneral@kalro.org Tovuti: www.kalro.org
F: Status of TIMP Readiness (1.	1. Ready for up scaling
Ready for up scaling; 2. Requires	
validation 3. Requires further	
C: Contacts	
Contacts	Institute Director
Contacts	KALRO – ICRI Mtwapa
	P.O BOX 16-80109
	Mtwapa
	<u>kalro.mtwapa@kalro.org</u>
Lead organization and scientists	KALRO, Mtwapa: Muniu F.K., Menza M.,, Mwashumbe S.,
	Pole F.
Partner organizations and contacts	1. Pwani University, info@pu.ac.ke. W. Mbinda
	2. KEPHIS -kephisinfo@kephis.org, T. Kosium;
	3. AFA - info@afa.go.ke, T. Yawa

- 1. Evaluation for tolerance to cashew powdery mildew
- 2. Validation of kernel weight and kernel processing characteristics
- 3. Cost benefit analysis
- 4. Areas for further research
- 5. Nutritional and processing characteristics of the cashew apples
- 6. Validation of technology in new growing areas
- 7. Requires further research on cashew apple products

2.2.3 Cashew Variety KKorosho 81

TIMP Name	Cashew Variety KKorosho 81	_
		A81
	Cashew branch	Cashew kennels
Category (technology,	Technology	
nnovation or management		
A: Description of the technology	innovation or management practice	
Drohlam to be addressed	Decline in cashew production due to use of aged tree and	
Problem to be addressed	overreliance on low yielding cashew va quality and long maturity.	rieties with poor kernel
What is it? (TIMP description)	A cashew variety with the following traits:	
	Suitable in altitude of 10-1000m in agro-	ecological zones L2 lowland
	Marginal Sugarcane zone; L3 Coconut C	Cassava zone; L4 Cashewnut
	Cassava Zone; L5 Lowland Livestock	Millet zone; LM5 Lower
	Midland Livestock Millet Zone; LM4 N	Aarginal Cotton Zone; LM5
	Livestock Millet Zone; LM4 Marginal Cotton Zone and LM3 Cotton	
	Zone Sites: Kwale, Mombasa, Kilifi,	Tana River, Lamu, Taita
	Taveta, Kitui, Makueni, Tharaka Nithi Homa Bay (LM4), Kisumu (LM4), Siaya (LM4) and Busia (LM4). It has high yields of	
	3.9t/ha,55kg per tree per year at 5 year	rs with high nut and kernel
	weight of 4g. The variety has Medium plant height (6.2 m at 5 yea	
	fruit is a rad and angular apple.)	at 5 years old). The cashew
Instification	A high vielding variety suitable in main	r cashaw growing areas
Justification	and with high quality kernels and short	maturity duration
B: Assessment of dissemination	and scaling up/out approaches	matarity adjuiton.
Users of TIMP	Farmers, breeders, agriprenuers, extensi	on agencies, nurserv
	operators, traders, nut processors and co	nsumers.

Approaches used in dissemination	Farmer Field and Business School (FFBS)
•••	• Agricultural innovation platforms (AIP)
	• Demonstrations – On-farm and on station
	• Agricultural shows/exhibitions/field days
	• Trainings - workshops/Seminars/Meetings
	• Public and private Extension Agents
	Farmer to farmer extension models
	 Mass media – Electronic and print
	 Publications - posters/brochures/leaflets_manuals
	 Digital platforms – website dashboards Apps social media
	short message services
Critical/essential factors for	Participatory Implementation, stakeholder capacity building.
successful promotion	functioning nurseries close to farmers and stakeholder networks.
Partners/stakeholders for scaling	• MoALD, - extension services and regulation of on farm
up and their respective roles.	demonstration
	• KEPHIS – phytosanitary regulation and patenting of
	materials
	• NGOs and CBOs including FA (Farm Africa) Ten Senses
	Africa - Seedlings multiplication and technology
	dissemination
	 Farmer Groups - Adapt varieties Service provider econoics including micro finance econoics
	• Service provider agencies including micro-infance agencies such as MESPT and banks provide loans to suppliers and
	producers
	 Agro-vets - supply agrichemicals to farmers
	 Nut Processors Association of Kenya (NutPak – processors
	and manufacturers
	• Aggregators - establishment of nurseries and supply of
	planting materials to farmers
C: Current situation and future s	caling up
Counties where already promoted.	Kilifi, Kwale, Tana River, Lamu
Counties where TIMPs will be	To be up-scaled in Lamu, Kilifi and Kwale Counties
upscaled	To be validated in Taita Taveta, Kitui, Makueni, Tharaka Nithi,
1	Homa Bay, Kisumu, Siaya and Busia.
Challenges in development and	Low interest in cashewnut production 1
dissemination	• Limited investment in the crop,
	Limited publicity
	• Few functional local processing facilities
	• Low investment in research.
Suggestions for addressing the	• Investment in crop development (research,
challenges	extension, processing)
	• Strengthening cashew farmer organizations
	• Supportive policies such as subsidization of
	processing equipment and production inputs
	Ban on export of raw nuts

Lessons learned in up scaling, if any Social, environmental, policy and market conditions necessary for development and up-scaling	 Involvement of private nursery operators, other government agencies (County, KEPHIS and MoALD-AFA), Non-governmental agencies (Tens senses), MESPT has fast tracked the up scaling of the technology. Gender inclusiveness in crop research and development Capacity building of stakeholders Understanding the physical and biotic Environment in target ecologies Understanding community culture, preferences, and practices
D: Economic, gender, vulnerable	and marginalized groups (VMGs) considerations
Basic costs	Cost of production approximately KES 21,975
Estimated returns	Gross Margin KES 140,025
Gender issues and concerns in development, dissemination, adoption and scaling up	 Women and youth have limited access to productive resources such as land, credit, and quality seeds Women and youth have limited access to education, training and extension services Cashew trees are considered men's enterprises thereby limiting women control and benefit from them Men dominate decisions on cashew at the household and community Women perform most of the weeding and processing activities
Gender related opportunities	Opportunities for women exists in the node of nursery establishment where they can operate them as business enterprises.
VMG issues and concerns in development, dissemination, adoption and scaling up	 VMGs have limited access to productive resources such as land, credit, and quality seeds VMGs have limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities VMGs have limited access to seed and information on new varieties and production techniques There is low adoption by VMGs due lack of awareness
VMG related opportunities	 VMGs have opportunities in seed sorting, potting and grafting, cottage processing and marketing. Affirmative action opportunities such as the women and youth enterprise fund exists for VMGs to access the required credit.
E: Case studies/profiles of success	stories
Success stories	 Increased uptake of KALRO cashew grafted seedlings of the new variety Technology adoption among private players and NGOs is increasing Individual farmers who have planted the variety and plantations

Application guidelines for users	1. Cashew planting guide, KALRO Mtwapa
	2. Cashew for Cash booklet, KALRO Mtwapa
	3. KALRO Cashew Nut
	https://play.google.com/store/apps/details?id=com.andromo.de
	<u>v724321.app928007</u>
	4. Cashew Nut Production, A reference handbook for farmers in
	Kenya, Muniu F.K. KALRO Email: directorgeneral@kalro.org
	Website: <u>www.kalro.org</u>
	5. Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima Nchini
	Kenya, Muniu F.K. KALRO Barua Pepe:
	directorgeneral@kalro.org Tovuti: <u>www.kalro.org</u>
F: Status of TIMP Readiness (1.	1. Ready for up scaling in traditional cashew growing areas
Ready for up scaling; 2. Requires	
validation; 3. Requires further	
research)	
G: Contacts	
Contacts	The Institute Director,
	KALRO –ICRI Mtwapa
	kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO, Mtwapa: Muniu F.K., Menza M., Mwashumbe S., Pole
	F
Partner organizations	Pwani University, info@pu.ac.ke. W. Mbinda; KEPHIS,
	kephisinfo@kephis.org;T. Kosium; AFA - info@afa.go.ke; T.
	Yawa

- 1. Evaluation for tolerance to powdery mildew
- 2. Validation of net kernel weight and kernel processing characteristics
- 3. Cost benefit analysis areas for further research
- 4. Nutritional and processing characteristics of the apple
- 5. Validation of technology in new growing areas
- 6. Requires further research on cashew apple products

2.2.4 Cashew Variety KKorosho 82

TIMP Name	Cashew Variety KKorosho 82	A82
	Cashew apple	Cashew kennels
Category (technology,	Technology	
innovation		
or management practice)		

A: Description of the technology, innovation or management practice		
Problem to be addressed	Decline in cashew production due to use of aged tree and	
	overreliance on low yielding cashew varieties with poor kernel	
	quality and long maturity.	
What is it? (TIMP description)	A cashew variety with the following traits:	
	Suitable in altitude of 10-1000m in agro-ecological zones L2 lowland	
	Marginal Sugarcane zone; L3 Coconut Cassava zone; L4 Cashewnut	
	Cassava Zone; L5 Lowland Livestock Millet Zone; LM5 Lower Midland	
	Millet Zone: LM4 Marginal Cotton Zone: LM3 Cotton Zone Sites:	
	Kwale, Mombasa, Kilifi, Tana River, Lamu, Taita Taveta, Kitui,	
	Makueni, Tharaka Nithi Homa Bay (LM4), Kisumu (LM4), Siaya	
	(LM4) and Busia (LM4). It has high yields of 3.9t/ha (55kg per tree per	
	year at 5 years) and very high nut and kernel weight (9.0g) . The variety	
	has a medium plant height of 5.7 m at 5 years old with an upright	
	and compact canopy (10.3m at 5 years old). The apples are yellow and	
Instification	angular.	
Justification	with high quality kernels and short maturity duration.	
B: Assessment of dissemination	and scaling up/out approaches	
Users of TIMP	Farmers, Breeders, Agripreneurs, extension agencies, Nursery	
	operators, Traders, Nut processors and fruits Consumers	
Approaches used in	• Farmer Field and Business School (FFBS)	
dissemination	Agricultural innovation platforms (AIP)	
	• Demonstrations – On-farm and on station	
	Agricultural shows/exhibitions/field days	
	Trainings - workshops/Seminars/Meetings	
	Public and private Extension Agents	
	• Farmer to farmer extension models	
	• Mass media – Electronic and print	
	• Publications - posters/brochures/leaflets, manuals	
	• Digital platforms – Website, Dashboards, Apps, social media	
	short message service	
Critical/essential factors for	Participatory Implementation	
successful promotion	• Stakeholder capacity building	
	Functioning nurseries in close to farmers Stokeholder networks	
Partners/stakeholders for scaling	 Stakeholder hetworks MoALD extension services and regulation of on farm 	
up and their respective roles	demonstration	
	• KEPHIS - phytosanitary regulation and patenting of materials	
	• NGOs including FA(Farm Africa), Ten Senses Africa and	
	CBOs - Seedlings multiplication and technology dissemination	
	 Farmer Groups - to adopt varieties Service provider agencies including micro-finance agencies 	
	such as MESPT, banks, - provide loans to suppliers and	
	producers	
	• Agro-vets - supply agrichemicals to farmers	

	• Nut Processors Association of Kenya (NutPak). processors and
	 Aggregators - establishment of nurseries and supply of
	planting materials to farmers
C: Current situation and future	e scaling up
Counties where already	Kilifi, Kwale, Tana River, Lamu
promoted. if any	
Counties where TIMPs will	• To be up-scaled in Lamu, Kilifi and Kwale Counties
be upscaled	• To be validated in Taita Taveta, Kitui, Makueni, Tharaka Nithi, Homa Bay, Kisumu, Siaya and Busia.
Challenges in development and	• Low interest in cashewnut production
dissemination	• Limited investment in the crop
	Limited publicity
	• Few functional local processing facilities
	Low investment in research
Suggestions for addressing the	• Investment in crop development (research, extension,
chanenges	processing)
	 Strengthening cashes armer organizations Supportion policies such as subsidiration of processing
	• Supportive policies such as subsidization of processing equipment and production inputs han on export of raw puts
Lessons learned in up scaling if	Involvement of private nursery operators, other government agencies
anv	(County, KEPHIS and MoALD-AFA). Non-governmental agencies
	(Tens senses), MESPT has fast tracked the up scaling of the
	technology.
Social, environmental, policy	• Gender inclusiveness in crop research and development
and market conditions necessary	• Capacity building of stakeholders
for development and up-scaling	• Onderstanding the physical and blotic environment in target
	 Understanding community culture preferences and
	practices
D: Economic, gender, vulnerab	le and marginalized groups (VMGs) considerations
Basic costs	Cost of production approximately KES 21,975
Estimated returns	Gross Margin KES 113,025
Gender issues and concerns in	• Women and youth have limited access to productive resources
development, dissemination,	such as land, credit, and quality seeds than men
adoption and scaling up	• Women and youth have limited access to education, training and
	extension services than men
	• Cashew trees are considered men's enterprises thereby
	Imiting women control and benefit from them
	With utilinate decisions on cashew at the nousehold and community
	• Women perform most of the weeding and processing activities
Gender related opportunities	Opportunities for women exists in node nursery establishment where
	they can operate them as business enterprises
VMG issues and concerns in	• VMGs have limited access to productive resources such as
development, dissemination,	land, credit, and quality seeds
adoption and scaling up	VMGs have limited access to training and extension

	services	
	• Due to their social status VMGs are often excluded from	
	decision making in development and dissemination activities	
	• VMGs have limited access to seed and information on new	
	varieties and production techniques	
	• There is low adoption by VMGs due lack of awareness	
VMG related opportunities	 VMGs have opportunities in seed sorting potting and 	
vivio related opportunities	grafting cottage processing and marketing	
	• Affirmative action opportunities such as the women and	
	vouth enterprise fund exists for VMGs to access the	
	required credit	
E: Case studies/profiles of succ	ess stories	
Conservation	Lucreace densities of KALDO cost one on first and the	
Success stories	• Increased uptake of KALRO cashew grafted seedings of the	
	new variety	
	• Technology adoption among private players and NGOs is	
	increasing	
	• Individual farmers who have planted the variety and	
	plantations	
Application guidelines for users	Cashew planting guide, KALRO Mtwapa	
	Cashew for Cash booklet, KALRO Mtwapa	
	KALRO Cashew Nut	
	https://play.google.com/store/apps/details?id=com.andromo.dev7	
	<u>24321.app928007</u>	
	• Cashew Nut Production, A reference handbook for farmers in	
	Kenya Muniu F.K. KALRO Email: directorgeneral@kalro.org	
	Website: www.kalro.org	
	• Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima Nchini	
	Kenya, Muniu F.K. KALRO Barua Pepe:	
	directorgeneral@kalro.org Tovuti: www.kalro.org	
F: Status of TIMP Readiness	1. Ready for up scaling in traditional cashew growing areas	
(1. Ready for up scaling; 2.		
Requires validation: 3.		
Requires further research)		
G: Contacts		
Contacts	The Institute Director	
Contacts	KALRO –ICRI Mtwana	
	kalro.mtwapa@kalro.org	
Lead organization and scientists	KALRO, Mtwapa: Muniu F.K., Menza M., Mwashumbe S., Pole F.	
Partner organizations and	1 Pwani University info@pu ac ke W Mbinda:	
contacts	2. KEPHIS kephisinfo@kephis.org T Kosium	
	3. AFA - info@afa.go.ke: T. Yawa	

- 1. Evaluation for tolerance to cashew powdery mildew
- Validation of kernel weight and kernel processing characteristics Cost benefit analysis 2.
- 3.
- Areas for further research 4.

- Nutritional and processing characteristics of the apple Validation of technology in new growing areas 5.
- 6.

TIMP Name	Cashew Variety A90
Category	Technology
(technology	Teemiorogy
innovation	
or management	
practice)	
A: Description of th	e technology, innovation or management practice
Problem to be	Decline in cashew production due to use of aged tree and overreliance on low
addressed	yielding cashew varieties with poor kernel quality and long maturity.
What is it? (TIMP	A cashew variety with the following traits:
description)	Suitable in altitude of 10-1000m in agro-ecological zones, L2 lowland Marginal
	Sugarcane zone; L3 Coconut Cassava zone; L4 Cashewnut Cassava Zone; L5 Lowland
	Livestock Millet zone; LM5 Lower Midland Livestock Millet Zone; LM4 Marginal
	Cotton Zone; LM5 Livestock Millet Zone; LM4 Marginal Cotton Zone; LM3 Cotton
	Zone. Sites in Kwale, Mombasa, Kilifi, Tana River, Lamu, Taita Taveta, Kitui,
	Makueni, Tharaka Nithi Homa Bay (LM4), Kisumu (LM4), Siaya (LM4) and Busia
	(LM4). It has high yields of 33 kg per tree and high nut and kennel weight of 7.5g.
	The variety has low plant height (4.6m at 5years) and low canopy width (6.6m at 5
T	years). The apples is yellow and rounded.)
Justification	A high yielding variety suitable in major cashew growing areas and with high
B· Assessment of di	ssemination and scaling un/out approaches
Ligara of TIMP	Formars Braders Agripropaurs Extension agancies Nursery operators Traders Nut
	processors and Fruit processors and Consumers
Approaches used in	Farmer Field and Business School (FFBS)
dissemination	 Agricultural innovation platforms (AIP)
	 Demonstrations – On-farm and on station
	• Agricultural shows/exhibitions/field days
	• Trainings - workshops/Seminars/Meetings
	Public and private Extension Agents
	• Farmer to farmer extension models
	• Mass media – Electronic and print
	Publications - posters/brochures/leaflets, manuals
	• Digital platforms – Website, Dashboards, Apps, Social media short message

2.2.5 **Cashew Variety A90**

	services
Critical/essential	Participatory Implementation
factors for successful	Stakeholder capacity building
promotion	• Functioning nurseries in close to farmers
-	Stakeholder networks
Partners/stakeholders	MoALD - Extension services and regulation of on farm demonstration
for scaling up and	• KEPHIS - Phytosanitary regulation and patenting of materials
their respective	• NGOs including FA(Farm Africa, Ten Senses Africa) and CBOs - Seedlings
roles.	multiplication and technology dissemination
	• Farmer Groups – Adopt varieties
	• Service provider agencies including micro-finance agencies such as MESPT and
	banks – Provide loans to suppliers and producers
	• Agro- vets - supply agrichemicals to farmers
	• Aggregators establishment of nurseries and supply of planting materials to
	farmers
	• Nut Processors Association of Kenya (NutPak) - processors and manufacturers
C: Current situation	n and future scaling up
Counties where	None
already promoted. if	
any	
Counties where	To be validated in Kilifi, Kwale, Lamu ,Tana River, Taita Taveta, Kitui, Makueni,
TIMPs will be	Tharaka Nithi, Homa Bay, Kisumu, Siaya and Busia.
Challongos in	- Low interact in apphaumut production
development and	Low Interest in cashe while production Limited investment in the crop
dissemination	Limited nivesuitent in the crop Limited publicity
dissemination	 Few functional local processing facilities
	 Low investment in research
Suggestions for	 Investment in crop development (research, extension, processing)
addressing the	 Strengthening cashew farmer organizations
challenges	• Supportive policies such as subsidization of processing equipment and
	production inputs
	• Ban on export of raw nuts
Lessons learned in	Involvement of private nursery operators, other government agencies (County, KEPHIS
up scaling, if any	and MoALD-AFA), Non-governmental agencies (Tens senses), MESPT has fast tracked
Cociol	the up scaling of the technology.
Social,	Gender inclusiveness in crop research and development Conscitu building of stakeholders
policy and market	 Capacity building of stational st
policy and marker	 Understanding the physical and block environment in target ecologies Understanding community culture preferences and practices
necessary for	• Onderstanding community culture, preferences, and practices
development and	
un-scaling	
D: Economic, gende	r, vulnerable and marginalized groups (VMGs) considerations
Basic costs	Approximate cost of production per acre KES 21.975
Estimated returns	Gross Margin KES 67 125
Estimated fetams	Gross mughi field 07,125

Gender issues and	• Women and youth have limited access to productive resources such as land,
concerns in	credit, and quality seeds
development,	• Women and youth have limited access to education, training and extension
dissemination,	services
adoption and scaling	• Cashew trees are considered men's enterprises thereby limiting women
up	control and benefit from them
-	• Men dominate decisions on cashew at the household and community
	• Women perform most of the weeding and processing activities
Gender related	Opportunities for women exists in node nursery establishment where they can
opportunities	operate them as business enterprises.
VMG issues and	• VMGs have limited access to productive resources such as land, credit, and
concerns in	quality seeds
development.	 VMGs have limited access to training and extension services
dissemination	• Due to their social status VMGs are often excluded from decision making in
adoption and scaling	development and dissemination activities
un un	 VMGs have limited access to seed and information on new varieties and
up	production techniques
	• There is low adoption by VMGs due lack of awareness
VMG related	 Micro is low adoption by Vivios due lack of awareness VMGs have opportunities in seed sorting, potting and grafting, cottage
opportunities	• vivios have opportunities in seed sorting, potting and granting, cottage
opportunities	• Affirmative action apportunities such as the woman and youth enterprise
	• Annuative action opportunities such as the women and youth enterprise
F. Case studies/prof	files of success stories
E. Case studies/pro	
Success stories	• Increased uptake of KALRO cashew grafted seedlings of the new variety
	• Technology adoption among private players and NGOs is increasing
	• Individual farmers who have planted the variety and plantations
Application	1. Cashew planting guide, KALRO Mtwapa
guidelines for users	2. Cashew for Cash booklet, KALRO Mtwapa
	3. KALRO Cashew Nut
	https://play.google.com/store/apps/details?id=com.andromo.dev724321.app928007
	4. Cashew Nut Production, A reference handbook for farmers in Kenya, Muniu F.K.
	KALRO Email: directorgeneral@kalro.org Website: <u>www.kalro.org</u>
	5. Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima Nchini Kenya, Muniu F.K.
	KALRO Barua Pepe: directorgeneral@kalro.org Tovuti: www.kalro.org
F: Status of TIMP	2. Requires validation
Readiness (1. Ready	
For up scaling; 2.	
3. Requires further	
research)	
G: Contacts	
Contacts	The Institute Director.
	KALRO –ICRI Mtwapa
	kalro.mtwapa@kalro.org
Lead organization	KALRO, Mtwapa: Muniu F.K., Menza M., Mwashumbe S., Pole F.
and scientists	
Partner	Pwani University, info@pu.ac.ke. Mbinda W.:
organizations and	KEPHIS, kephisinfo@kephis.org: Kosium T.:
contacts	AFA - info@afa.go.ke: Yawa T.

- 1. Evaluation for tolerance to powdery mildew
- 2. Validation of net kernel weight and kernel processing characteristics
- 3. Cost benefit analysis areas for further research
- 4. Nutritional and processing characteristics of the apple
- 5. Validation of technology in new growing areas

TIMP Name **Cashew Variety A41** Red and obliquely flattened apple Category (technology, Technology innovation or management practice) A: Description of the technology, innovation or management practice Decline in cashew production due to use of aged tree and Problem to be addressed overreliance on low yielding cashew varieties with poor kernel quality and long maturity A cashew variety with the following traits: What is it? (TIMP description) Suitable in altitude of 10-1000m in agro-ecological zones, L2 lowland Marginal Sugarcane zone; L3 Coconut Cassava zone; L4 Cashewnut Cassava Zone; L5 Lowland Livestock Millet zone; LM5 Lower Midland Livestock Millet Zone; LM4 Marginal Cotton Zone; LM5 Livestock Millet Zone:: LM3 Cotton Zone Sites in Kwale, Mombasa, Kilifi, Tana River, Lamu, Taita Taveta, Kitui, Makueni, Tharaka Nithi Homa Bay (LM4), Kisumu (LM4), Siaya (LM4) and Busia (LM4). The variety has high yields (36 kg per tree) and medium nut and kernel weight (2.5g). it has low plant height (4.5m at 5 years) and medium canopy width (4.5m at 5 years). The apples is red and obliquely flattened. A high yielding variety suitable in major cashew growing areas Justification and with high quality kernels and short maturity duration. **B:** Assessment of dissemination and scaling up/out approaches Users of TIMP • Farmers, Agripreneurs, Breeders, Extension agencies, Nursery operators, Traders, Nut and fruit processors and Consumers Approaches used in dissemination Farmer Field and Business School (FFBS) ٠ Agricultural innovation platforms (AIP) • Demonstrations – On-farm and on station • Agricultural shows/exhibitions/field days • Trainings - workshops/Seminars/Meetings •

2.2.6 Cashew Variety A41

	Public and private Extension Agents
	• Farmer to farmer extension models
	• Mass media – Electronic and print
	• Publications - posters/brochures/leaflets, manuals
	• Digital platforms – Website, Dashboards, Apps, Social media
	short message services
Critical/essential factors for	Participatory Implementation
successful promotion	• Stakeholder capacity building
-	• Functioning nurseries in close to farmers
	• Stakeholder networks
Partners/stakeholders for scaling	• MoALD - Extension services and regulation of on farm
up and their respective roles.	demonstration
1 1	• KEPHIS - Phytosanitary regulation and natenting of materials
	• NGOs including FA(Farm Africa Ten Senses Africa) and
	CBOs - Seedlings multiplication and technology
	dissemination
	• Farmer Groups – Adopt varieties
	• Service provider agencies including micro-finance agencies
	such as MESPT and banks – Provide loans to suppliers and
	producers
	• A gro- vets - supply agrichemicals to farmers
	• Aggragators establishment of nurseries and supply of
	 Aggregators establishment of nurseries and suppry of planting materials to farmers
	 Nut Processors Association of Kenya (NutPak) - processors
	and manufacturers
C: Current situation and future s	caling up
Counties where already promoted.	None
if any	
Counties where TIMPs will be	To be validated in Kilifi Kwale, Lamu, Tana River, Taita Taveta
Upscaled	Kitui Makueni Tharaka Nithi Homa Bay Kisumu Siava and
	Busia.
Challenges in development and	• Low interest in cashewnut production
dissemination	• Limited investment in the crop
	Limited publicity
	• Few functional local processing facilities
	• Low investment in research
Suggestions for addressing the	• Investment in crop development (research, extension,
challenges	processing)
	• Strengthening cashew farmer organizations
	• Supportive policies such as subsidization of processing
	equipment and production inputs, ban on export of raw nuts
Lessons learned in up scaling, if	Involvement of private nursery operators, other government
any	agencies (County, KEPHIS and MoALD-AFA), Non-
any	agencies (County, KEPHIS and MoALD-AFA), Non- governmental agencies (Tens senses), MESPT has fast tracked the
any	agencies (County, KEPHIS and MoALD-AFA), Non- governmental agencies (Tens senses), MESPT has fast tracked the up scaling of the technology.
Social, environmental, policy and	 agencies (County, KEPHIS and MoALD-AFA), Non-governmental agencies (Tens senses), MESPT has fast tracked the up scaling of the technology. Gender inclusiveness in crop research and development
Social, environmental, policy and market conditions necessary for	 agencies (County, KEPHIS and MoALD-AFA), Non-governmental agencies (Tens senses), MESPT has fast tracked the up scaling of the technology. Gender inclusiveness in crop research and development Capacity building of stakeholders
Social, environmental, policy and market conditions necessary for development and up-scaling	 agencies (County, KEPHIS and MoALD-AFA), Non- governmental agencies (Tens senses), MESPT has fast tracked the up scaling of the technology. Gender inclusiveness in crop research and development Capacity building of stakeholders Understanding the physical and biotic Environment in target

	Understanding community culture, preferences, and practices	
D: Economic, gender, vulnerable	and marginalized groups (VMGs) considerations	
Basic costs	Approximate cost of production per acre KES 21,975	
Estimated returns	Gross Margin KES 75,225	
Gender issues and concerns in development, dissemination, adoption and scaling up	 Women and youth have limited access to productive resources such as land, credit, and quality seeds Women and youth have limited access to education, training and extension services 	
	 Cashew trees are considered a s men's enterprises thereby limiting women control and benefit from them Men dominate decisions on cashew at the household and community Women perform most of the weeding and processing activities 	
Gender related opportunities	Opportunities for women exists in the node of nursery establishment where they can operate them as business enterprises	
VMG issues and concerns in development, dissemination, adoption and scaling up	 VMGs have limited access to productive resources such as land, credit, and quality seeds VMGs have limited access to training and extension services 	
	 Due to their social status VMGs are often excluded from decision making in development and dissemination activities VMGs have limited access to seed and information on new varieties and production techniques There is low adoption by VMGs due lack of awareness 	
VMG related opportunities	 VMGs have opportunities in seed sorting, potting and grafting, cottage processing and marketing. Affirmative action opportunities such as the women and youth enterprise fund exists for VMGs to access the required credit. 	
E: Case studies/profiles of success stories		
Success stories	 Increased uptake of KALRO cashew grafted seedlings of the new variety Technology adoption among private players and NGOs is increasing Individual farmers who have planted the variety and plantations 	
Application guidelines for users	 Cashew planting guide, KALRO Mtwapa Cashew for Cash booklet, KALRO Mtwapa KALRO Cashew Nut https://play.google.com/store/apps/details?id=com.andromo.de v724321.app928007 Cashew Nut Production, A reference handbook for farmers in Kenya, Muniu F.K. KALRO Email: directorgeneral@kalro.org Website: www.kalro.org 	
	5. Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima Nchini	
	Kenva, Muniu F.K. KALRO directorgeneral@kalro.org	
------------------------------------	---	
	Tovuti: www.kalro.org	
F: Status of TIMP Readiness (1.	2. Requires validation	
Ready for up scaling; 2. Requires		
validation;3. Requires further		
research)		
G: Contacts		
Contacts	The Institute Director,	
	KALRO –ICRI Mtwapa,	
	kalro.mtwapa@kalro.org	
Lead organization and scientists	KALRO, Mtwapa: Muniu F.K., Menza M., Mwashumbe S., Pole	
	F.	
Partner organizations and contacts	Pwani University, info@pu.ac.ke. W. Mbinda;	
	KEPHIS, kephisinfo@kephis.org;T. Kosium;	
	AFA - info@afa.go.ke; T. Yawa	

- Evaluation for tolerance to powdery mildew
 Validation of net kernel weight and kernel processing characteristics
- 3. Cost benefit analysis Areas for further research:
- 4. Requires further research on cashew apple products
- 5. Validation of technology in new growing areas

TIMP Name	Cashew Variety JK90
Category (technology, innovation or management practice)	Technology
A: Description of the technology,	innovation or management practice
Problem to be addressed	Decline in cashew production due to use of aged tree and overreliance on low yielding cashew varieties with poor kernel quality and long maturity
What is it? (TIMP description)	A cashew variety with the following traits:

2.2.7 Cashew Variety JK90

	Suitable in altitude of 10-1000m in agro-ecological zones, L2 lowland Marginal Sugarcane zone; L3 Coconut Cassava zone; L4 Cashewnut Cassava Zone; L5 Lowland Livestock Millet zone; LM5 Lower Midland Livestock Millet Zone; LM4 Marginal Cotton Zone; LM5 Livestock Millet Zone; LM3 Cotton Zone Sites: Kwale, Mombasa, Kilifi, Tana River, Lamu, Taita Taveta, Kitui, Makueni, Tharaka Nithi Homa. The variety has high yields (35kg per tree), high nut and kernel weight (5g). It has low plant
	height (5m at 5 years) and medium canopy width (8.3m at 5
Institution	years). The apple is red and pyriform in shape
Justification	and with high quality kernels and short maturity duration.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers, Breeders, Agripreneurs, Extension agencies, Nursery
	operators, Traders, Nut processors and fruits and Consumers
Approaches used in dissemination	 Farmer Field and Business School (FFBS) Agricultural innovation platforms (AIP)
	 Agricultural innovation platforms (All) Demonstrations – On-farm and on station
	 Agricultural shows/exhibitions/field days
	• Trainings - workshops/Seminars/Meetings
	Public and private Extension Agents
	• Farmer to farmer extension models
	• Mass media – Electronic and print
	• Publications - posters/brochures/leaflets, manuals
	• Digital platforms – Website, Dashboards, Apps, Social media
	short message services
Critical/essential factors for	Participatory Implementation
successful promotion	• Stakeholder capacity building
	 Functioning nurseries in close to farmers Stakeholder networks
Partners/stakeholders for scaling	 MoALD - Extension services and regulation of on farm
up and their respective roles.	demonstration
	 KEPHIS - Phytosanitary regulation and patenting of materials NGOs including FA(Farm Africa, Ten Senses Africa) and CBOs - Seedlings multiplication and technology
	• Earmar Groups Adopt variation
	 Farmer Groups – Adopt varieties Service provider agencies including micro-finance agencies
	such as MESPT and banks – Provide loans to suppliers and producers
	• Agro- vets - supply agrichemicals to farmers
	• Aggregators establishment of nurseries and supply of
	planting materials to farmers
	Nut Processors Association of Kenya (NutPak) - processors and menufactures
C. Current situation and future s	and manufacturers
Counting where already around a	• None
if any	

Counties where TIMPs will be	To be validated in Kilifi, Kwale, Lamu , Tana River, Taita Taveta,
upscaled or validated	Kitui, Makueni, Tharaka Nithi, Homa Bay, Kisumu, Siaya and
	Busia.
Challenges in development and	• Low interest in cashewnut production
dissemination	• Limited investment in the crop
	Limited publicity
	Few functional local processing facilities
	Low investment in research
Suggestions for addressing the	• Investment in crop development (research, extension,
challenges	processing)
	Strengthening cashew farmer organizations
	• Supportive policies such as subsidization of processing
	equipment and production inputs, ban on export of raw nuts
Lessons learned in up scaling, if	Involvement of private nursery operators, other government
any	agencies (County, KEPHIS and MOALD-AFA), Non-governmental
	of the technology
Social environmental policy and	• Gender inclusiveness in crop research and development
market conditions necessary for	 Capacity building of stakeholders
development and up-scaling	• Understanding the physical and biotic environment in target
	ecologies
	• Understanding community culture, preferences, and
	practices
D: Economic, gender, vulnerable	and marginalized groups (VMGs) considerations
Basic costs	Approximate cost of production per acre KES 21,975
Estimated returns	Gross Margin KES 72,525
Gender issues and concerns in	• Women and youth have limited access to productive
development, dissemination.	resources such as land, credit, and quality seeds
adoption and scaling up	• Women and youth have limited access to education, training
	and extension services
	• Cashew trees are considered men's enterprises thereby
	limiting women control and benefit from them
	• Men dominate decisions on cashew at the household and
	community
	• Women perform most of the weeding and processing activities
Gender related opportunities	Opportunities for women exists in the node of nursery
	establishment where they can operate them as business
	enterprises
VMG issues and concerns in	• VMGs have limited access to productive resources such as
development, dissemination,	land, credit, and quality seeds
adoption and scaling up	• VMGs have limited access to training and extension
	services
	• Due to their social status VMGs are often excluded from
	decision making in development and dissemination
	activities
	• VMGs have limited access to seed and information on new
	varieties and production techniques
VMC related area to 't'	Inere is low adoption by VMGs due lack of awareness
vivid related opportunities	• viviGs nave opportunities in seed sorting, potting and

	grafting, cottage processing and marketing.
	• Affirmative action opportunities such as the women and
	vouth enterprise fund exists for VMGs to access the
	required credit.
E: Case studies/profiles of success	stories
Success stories	• Increased uptake of KALRO cashew grafted seedlings of the
	new variety
	• Technology adoption among private players and NGOs is
	increasing
	• Individual farmers who have planted the variety and
	plantations
Application guidelines for users	Cashew planting guide, KALRO Mtwapa
	• Cashew for Cash booklet, KALRO Mtwapa
	KALRO Cashew Nut
	https://play.google.com/store/apps/details?id=com.andromo.d
	<u>ev724321.app928007</u>
	Cashew Nut Production, A reference handbook for farmers in
	Kenya, Muniu F.K. KALRO Email:
	directorgeneral@kalro.org Website: <u>www.kalro.org</u>
	Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima
	Nchini Kenya, Muniu F.K.
	KALRO)directorgeneral@kalro.org Tovuti: www.kalro.org
F: Status of TIMP Readiness (1.	2. Requires validation
Ready for up scaling; 2. Requires	
validation;3. Requires further	
research)	
G: Contacts	
Contacts	The Institute Director,
	KALRO –ICRI Mtwapa
	kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO, Mtwapa: Muniu F.K., Menza M., Mwashumbe S., Pole
	F.
Partner organizations and contacts	Pwani University, info@pu.ac.ke.
	W. Mbinda,; KEPHIS, <u>kephisinfo@kephis.org</u> ;
	T. Kosium; AFA - <u>info@afa.go.ke;</u>
	T. Yawa

- 1. Evaluation for tolerance to powdery mildew
- 2. Validation of net kernel weight and kernel processing characteristics
- 3. Cost benefit analysis
- 4. Areas for further research
- 5. Requires further research on cashew apple products

2.2.8 Cashew Variety JK460

TIMP Name	Cashew Variety JK460

	A mature cashew fruit
Category (technology,	Technology
innovation or management	
practice)	
A: Description of the technol	ogy, innovation or management practice
Problem to be addressed	Decline in cashew production due to use of aged tree and over reliance
	on low yielding cashew varieties with poor kernel quality and long maturity
What is it? (TIMP description)	A cashew variety with the following traits:
	Suitable in altitude of 10-1000m in agro-ecological zones, L2 lowland
	Marginal Sugarcane zone; L3 Coconut Cassava zone; L4 Cashewnut
	Cassava Zone; L5 Lowland Livestock Millet zone; LM5 Lower Midland
	Livestock Millet Zone; LM4 Marginal Cotton Zone; LM5 Livestock
	Millet Zone; LM3 Cotton Zone.
	Sites in Kwale, Mombasa, Kilifi, Tana River, Lamu, Taita Taveta,
	Kitui, Makueni, Tharaka Nithi Homa. It has high yields (34kg per
	tree) and medium nut and kernel weight (2.5g). The variety has
	medium plant height (5.3m at 5 years old) and medium canopy width
	(8.4m at 5 years old). The apples are red and angular.
Justification	A high yielding variety suitable in major cashew growing areas and
B: Assossment of dissemination	with high quality kernels and short maturity duration.
D. Assessment of dissemination	
Users of TIMP	Farmers, Extension, Breeders, Agripreneurs, Agencies, Nursery
	operators, Traders, Nut and fruit processors and Consumers
Approaches used in	• Farmer Field and Business School (FFBS)
dissemination	• Agricultural innovation platforms (AIP)
	• Demonstrations – On-farm and on station
	• Agricultural snows/exhibitions/field days
	• Irainings - worksnops/Seminars/Meetings
	Fublic and private Extension Agents Former to former outencion models
	• Farmer to farmer extension models
	 Mass media – Electronic and print Publications – posters/brochures/loaflets – manuals
	 Digital platforms Website Dashboards Apps Social media short
	• Digital platornis – website, Dashobards, Apps, Social media short
Critical/essential factors for	Participatory Implementation
successful promotion	Stakeholder capacity building
	• Functioning nurseries close to farmers
	Stakeholder networks
Partners/stakeholders for	MoALD - Extension services and regulation of on farm

scaling up and their respective	demonstration
roles.	• KEPHIS - Phytosanitary regulation and patenting of materials
	• NGOs including FA(Farm Africa, Ten Senses Africa) and CBOs -
	Seedlings multiplication and technology dissemination
	Farmer Groups – Adopt varieties
	• Service provider agencies including micro-finance agencies such as
	MESPT and banks – Provide loans to suppliers and producers
	• Agro- vets - supply agrichemicals to farmers
	• Aggregators establishment of nurseries and supply of planting
	materials to farmers
	• Nut Processors Association of Kenya (NutPak) - processors and
	manufacturers
C: Current situation and fut	are scaling up
Counties where already	None
promoted. if any	
Counties where TIMPs will	To be validated in Kilifi, Kwale, Lamu , Tana River, Taita Taveta, Kitui,
be upscaled	Makueni, Tharaka Nithi, Homa Bay, Kisumu, Siaya and Busia.
Challenges in development	• Low interest in cashewnut production
and dissemination	• Limited investment in the crop
	Limited publicity
	Few functional local processing facilities
	Low investment in research
Suggestions for addressing the	• Investment in crop development (research, extension,
challenges	processing)
	Strengthening cashew farmer organizations
	• Supportive policies such as subsidization of processing
	equipment and production inputs, and ban on export of raw nuts
Lessons learned in up scaling,	Involvement of private nursery operators, other government agencies
if any	(County, KEPHIS and MoALD-AFA), Non-governmental agencies
	(Tens senses), MESPT has fast tracked the up scaling of
Social anyironmental policy	Conder inclusiveness in eren research and development
and market conditions	 Gender inclusiveness in crop research and development Conscity building of stakeholders
and market conditions	 Capacity building of stakeholders Understanding the physical and histic anyironment in target
and up scaling	Condensitiationing the physical and blotte environment in target ecologies
and up-scanng	 Understanding community culture preferences and practices
D: Economic, gender, vulner	able and marginalized groups (VMGs) considerations
Basic costs	Approximate cost of production per acre KES 21 975
Estimated returns	Gross Margin KES 68 825
Conden isource and concorrection	We was and exactly here limited as an electric measure of
Gender issues and concerns in	• Women and youth have limited access to productive resources
adoption and acaling up	Such as faile, creatly and quality seeds
adoption and scaling up	• Women and youth have minted access to education, training and
	• Cashaw trace are considered as mon's enterprises thereby
	Cashew nees are considered as men s enterprises mereby limiting women control and henefit from them
	• Men dominate decisions on cashey at the household and
	community
	• Women perform most of the weeding and processing activities

Gender related opportunities	Opportunities for women exists in the node of nursery
	establishment where they can operate them as business
	enterprises
VMG issues and concerns in	• VMGs have limited access to productive resources such as land,
development, dissemination,	credit, and quality seeds
adoption and scaling up	• VMGs have limited access to training and extension
	services
	• Due to their social status VMGs are often excluded from
	decision making in development and dissemination activities
	• VMGs have limited access to seed and information on new
	varieties and production techniques
	• There is low adoption by VMGs due lack of awareness
VMG related opportunities	• VMGs have opportunities in seed sorting, potting and
	grafting, cottage processing and marketing.
	• Affirmative action opportunities such as the women and
	vouth enterprise fund exists for VMGs to access the required
	credit.
E: Case studies/profiles of su	ccess stories
Success stories	• Increased untake of KALRO cashew grafted seedlings of the new
	variety
	 Technology adoption among private players and NGOs is
	increasing
	• Individual farmers who have planted the variety and
	plantations
Application guidelines for	1. Cashew planting guide, KALRO Mtwapa
users	2 Cashew for Cash booklet KALRO Mtwana
	3 KALRO Cashew Nut
	https://play.google.com/store/apps/details?id=com.andromo.dev7
	24321 app928007
	4 Cashew Nut Production A reference handbook for farmers in
	Kenya Muniu FK KALRO Email: directorgeneral@kalro.org
	Website: www.kalro.org
	5 Ukuzaji Bora wa Mkorosho. Mwongozo wa Wakulima Nchini
	Kenya Muniu FK KKALRO directorgeneral@kalro org Toyuti:
	www.kalro.org
F• Status of TIMP Readiness	2 Requires validation
(1 Ready for up scaling: 2	2. Requires variation
Requires validation: 3	
Requires further research)	
G: Contacts	
Contacts	The Institute Director
Contacts	KALDO ICDI Mtwana
	kalro mtwapa@kalro org
Lead organization and	KALRO Mtwana Muniu: F.K. Menza M. Mwashumbe S. Pole F.
scientists	
Partner organizations and	Pwani University info@nu ac ke W Mbinda ·
contacts	KEPHIS kenhisinfo@kenhis.org. T Kosium.
contacts	AEA = info@afa go ke: T Vawa
1	11111 milo ana. 50. Ko, 1. 1 awa

- 1. Evaluation for tolerance to powdery mildew
- 2. Validation of net kernel weight and kernel processing characteristics
- 3. Cost benefit analysis areas for further research:
- 4. Requires further research on cashew apple products
- 5. SValidation of technology in new growing areas

TIMP Name	Cashew Variety JK228
Category (technology, innovation or management practice)	Technology
A: Description of the technology,	innovation or management practice
Problem addressed	Decline in cashew production due to use of aged trees and over reliance on low yielding cashew varieties with poor kernel quality and long maturity
What is it? (TIMP description)	A cashew variety with the following traits: High yields (at least 34 kg per tree); Medium nut and kernel weight (2.5g); Medium plant height (5.6 m at five years old); Medium canopy width (9.3 m at five years old); and red and flattened apples.
	 Iowland Marginal Sugarcane zone; L3 Coconut-Cassava zone; L4 Cashewnut-Cassava zone; L5 Lowland Livestock-Millet zone; LM5 Lower Midland Livestock-Millet zone; LM4 Marginal Cotton zone; LM5 Livestock-Millet zone; LM4 Marginal Cotton zone; LM3 Cotton zone Sites: Kwale, Mombasa, Kilifi, Tana River, Lamu, Taita Taveta, Kitui, Makueni, Tharaka Nithi, Homa Bay
Justification	A high yielding variety suitable in major cashew growing areas

2.2.9 Cashew Variety JK228

	and with high quality kernels and short maturity duration.	
B: Assessment of dissemination and scaling up/out approaches		
Users of TIMP	• Farmers, Extension agencies, Nursery operators, Traders, Nut	
	and fruit processors and Consumers	
Approaches used in dissemination	• Farmer Field and Business School (FFBS)	
	Agricultural innovation platforms (AIP)	
	• Demonstrations - On-farm and on station	
	• Agricultural shows/exhibitions/field days	
	• Trainings - workshops/Seminars/Meetings	
	• Public and private Extension Agents	
	• Farmer-to-farmer extension models	
	Mass media - Electronic and print	
	 Publications - posters/brochures/leaflets manuals 	
	 Digital Platforms - Website Dashboards Apps social media 	
	short message services	
Critical/essential factors for	Participatory Implementation	
successful promotion	Stakeholder capacity building	
	• Functional nurseries in close proximity to farmers	
	Stakeholder networks	
Partners/stakeholders for scaling	MoALD, KEPHIS, NGOs including FA (Farm Africa, Ten Senses	
up and their respective roles	Africa), CBOS, Farmer Groups, Service provider agencies	
	vets, processors and manufacturers, aggregators, Nut Processors	
	Association of Kenya (NutPak)	
C: Current situation and future s	caling up	
Counties where already promoted,	None	
if any		
Counties where TIMPs will be	To be validated in Kilifi, Kwale, Lamu , Tana River, Taita Taveta,	
upscaled	Kitui, Makueni, Tharaka Nithi, Homa Bay, Kisumu, Siaya and	
	Busia.	
Challenges in development and	• Low interest in cashewnut production	
dissemination	• Limited investment in the crop	
	 Limited publicity Few functional local processing facilities 	
	 Low investment in research 	
Suggestions for addressing the	Educate farmers on importance of cashew production	
challenges	• Strengthening cashew farmer organizations	
C C	• Supportive policies such as subsidization of processing	
	equipment and production inputs, ban on export of raw nuts	
	• Investment in crop development (research, extension,	
	processing)	
Lessons learned in up scaling, if	Involvement of private nursery operators, other government agencies (County KEPHIS and MoALD-AEA) Non-governmental	
any	agencies (Tens senses). MESPT has fast-tracked the up scaling of	
	the technology.	
Social, environmental, policy and	• Gender inclusiveness in crop research and development	
market conditions necessary for	• Understanding community culture, preferences, and	
development and up-scaling	practices	

	 Capacity building of stakeholders Understanding the physical and biotic Environment in target ecologies Determining the market requirements and processing techniques
D: Economic, gender, vulnerable	and marginalized groups (VMGs) considerations
Basic costs	Cost of production per acre KES 21,975.00
Estimated returns	Gross Margin KES 69,825.00
Gender issues and concerns in development, dissemination, adoption and scaling up	 Women and youth have limited access to productive resources such as land, credit and quality seeds compared to men Women and youth have limited access to education, training and extension services compared to men Cashew trees are considered men's enterprises thereby limiting women control and benefit from them Men dominate decisions on cashew at the household and community Women perform most of the weeding and processing activities
Gender related opportunities	Opportunities for women exists in the node of nursery establishment where they can operate them as business enterprises
VMG issues and concerns in development, dissemination, adoption and scaling up	 Limited access to productive resources such as land, credit information on new varieties, quality seeds and production techniques Limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities Low adoption due lack of awareness Opportunities in seed sorting, potting and grafting, cottage processing and marketing. Affirmative action opportunities such as the Women and Youth Enterprise Fund also exists for VMGs to access the required credit.
E: Case studies/profiles of success	stories
Success stories	 Increased uptake of KALRO cashew grafted seedlings of the new varieties Technology adoption among private players and NGOs is increasing The number of individual farmers who have planted the variety and plantations rising
Application guidelines for users	 Cashew planting guide, KALRO Mtwapa Cashew for Cash booklet, KALRO Mtwapa KALRO Cashew Nut <u>https://play.google.com/store/apps/details?id=com.andromo.dev724321.app928007</u> Cashew Nut Production, A reference handbook for farmers in Kenya, F.K. Muniu Kenya Agricultural and Livestock Research Organization (KALRO) Email:

	directorgeneral@kalro.org Website: www.kalro.org
	5. Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima
	Nchini Kenya, F.K. Muniu Kenya Agricultural and
	Livestock Research Barua Pepe: directorgeneral@kalro.org
	Tovuti: www.kalro.org
F: Status of TIMP Readiness (1.	1 .Ready for up scaling
Ready for up scaling; 2. Requires	
validation; 3. Requires further	
research)	
G: Contacts	
Contacts	Institute Director, KALRO – ICRI Mtwapa
	kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO, Mtwapa: F.K. Muniu, M. Menza, S. Mwashumbe, F.
	Pole
Partner organizations and contacts	Pwani University, info@pu.ac.ke W. Mbinda; KEPHIS - T.
	Kosium; AFA - T. Yawa

- 1. Evaluation for tolerance to powdery mildew
- 2. Validation of net kernel weight and kernel processing characteristics
- 3. Cost benefit analysis areas for further research
- 4. Requires further research on cashew apple products
- 5. Validation of technology in new growing areas

TIMP Name	Cashew Variety JK292
Category (technology,	Technology
innovation or management	
practice)	
A: Description of the technology,	innovation or management practice
Problem addressed	Decline in cashew production due to use of aged tree and over
	reliance on low yielding cashew varieties with poor kernel quality
	and long maturity
What is it? (TIMP description)	A cashew variety with the following traits: High yields (over 37 kg

2.2.10 Cashew Variety JK292

	 per tree); High nut and kernel weight (2.5g); Low plant height (4.9 m at five years old); Low canopy width (6.7 m at five years old); red and pyriform apples. Suitable in altitude of 10-1000m in agro-ecological zones L2 lowland Marginal Sugarcane zone; L3 Coconut-Cassava zone; L4 Cashewnut-Cassava zone; L5 Lowland Livestock-Millet zone; LM5 Lower Midland Livestock-Millet zone; LM4 Marginal Cotton zone; LM5 Livestock-Millet zone; LM4 Marginal Cotton Zone; LM3 Cotton Zone Sites: Kwale, Mombasa, Kilifi, Tana River, Lamu, Taita Taveta, Kitui, Makueni, Tharaka Nithi, Homabay
Justification B: Aggaggment of diagomination a	A high yielding variety suitable for major cashew growing areas with high quality kernels and short maturity duration.
B: Assessment of dissemination a	nd scaling up/out approaches
Users of TIMP	• Farmers, Extension agencies, Nursery operators, Traders, Nut
Approaches used in dissemination	Farmer Field and Business School (FFBS)
	 Agricultural innovation platforms (AIP)
	 Demonstrations - On-farm and on station
	 Agricultural shows/exhibitions/field days
	• Trainings - workshops/Seminars/Meetings
	Public and private Extension Agents
	• Farmer-to-farmer extension models
	• Mass media - Electronic and print
	• Publications - posters/brochures/leaflets, manuals
	• Digital Platforms - Website, Dashboards, Apps, social media short message services
Critical/essential factors for	Participatory Implementation
successful promotion	Stakeholder capacity building
	• Functional nurseries in close proximity to farmers
Partners/stakeholders for scaling	• Stakeholder networks MoALD KEPHIS NGOs including EA (Farm Africa Ten Senses
up and their respective roles.	Africa), CBOs, Farmer Groups, Service provider agencies
	including micro-finance agencies such as MESPT, banks, agro-vets,
	processors and manufacturers, aggregators, Nut Processors
C: Current situation and future s	Association of Kenya (NutPak).
Counties where already promoted	None
if any	
Counties where TIMPs will be	To be validated in Kilifi, Kwale, Lamu, Tana River, Taita Taveta,
upscaled	Kitui, Makueni, Tharaka Nithi, Homa Bay, Kisumu, Siaya and
	Busia.
Challenges in development and	Low interest in cashewnut production
dissemination	Limited investment in the crop
	• Limited publicity

	Few functional local processing facilities
	Low investment in research
Suggestions for addressing the	• Educate farmers on importance of cashew production
challenges	• Strengthening cashew farmer organizations
	• Investment in crop development (research, extension,
	processing)
	• Supportive policies such as subsidization of processing
	equipment and production inputs, ban on export of raw nuts
Lessons learned in up scaling, if	Involvement of private nursery operators, other government
any	agencies (County, KEPHIS and MoALD-AFA), Non-governmental
	agencies (Tens senses); MESPT has fast tracked the up scaling of
	the technology.
Social, environmental, policy and	• Gender inclusiveness in crop research and development
market conditions necessary for	• Capacity building of stakeholders
development and up-scaling	• Understanding the physical and biotic Environment in target
	ecologies
	• Onderstanding community culture, preferences, and
D: Economic, gender, vulnerable	and marginalized groups (VMGs) considerations
Basic costs	Cost of production KES 21,975.00
Estimated returns	Gross Margin KES 77,925.00
Gender issues and concerns in	• Women and youth have limited access to productive
development. dissemination.	resources such as land, credit, and quality seeds compared to
adoption and scaling up	men
and the second of the	• Women and youth have limited access to education, training
	and extension services compared to men
	• Cashew trees are considered men's enterprises thereby
	limiting women control and benefit from them
	• Men dominate decisions on cashew at the household and
	community
	• Women perform most of the weeding and processing activities
Gender related opportunities	Opportunities for women exists in the node of nursery establishment
	where they can operate them as business enterprises
VMG issues and concerns in	• Limited access to productive resources such as land, credit,
development, dissemination,	quality seeds and information on new varieties and
adoption and scaling up	production techniques
	 Limited access to training and extension services Due to their social status VMCs are often evoluded from
	Due to their social status vivios are often excluded from decision making in development and dissemination
	activities
	• There is low adoption by VMGs due lack of awareness
VMG related opportunities	• Seed sorting, potting and grafting, cottage processing and
TT TT	marketing.
	• Affirmative action opportunities such as the Women and
	Youth Enterprise Fund exists for VMGs to access the
	required credit.
E: Case studies/profiles of succes	s stories
Success stories	• Increased uptake of KALRO cashew grafted seedlings of the
	new variety

	 Technology adoption among private players and NGOs is increasing Individual farmers who have planted the variety and plantations
Application guidelines for users F: Status of TIMP Readiness (1.	 Cashew planting guide, KALRO Mtwapa Cashew for Cash booklet, KALRO Mtwapa KALRO Cashew Nut https://play.google.com/store/apps/details?id=com.andromo. dev724321.app928007 Cashew Nut Production, A reference handbook for farmers in Kenya, F.K. Muniu Kenya Agricultural and Livestock Research Organization Email: directorgeneral@kalro.org Website: www.kalro.org Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima Nchini Kenya, F.K. Muniu Kenya Agricultural and Livestock Research Organization directorgeneral@kalro.org Tovuti: www.kalro.org Ready for up scaling
Ready for up scaling; 2. Requires validation; 3. Requires further research)	
G: Contacts	
Contacts	Institute Director, KALRO –ICRI Mtwapa kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO, Mtwapa: F.K. Muniu, M. Menza, S. Mwashumbe, F. Pole
Partner organizations and contacts	Pwani University, <u>info@pu.ac.ke</u> - W. Mbinda; KEPHIS - T. Kosium; AFA - T. Yawa

- 1. Evaluation for tolerance to powdery mildew
- 2. Validation of net kernel weight and kernel processing characteristics
- 3. Cost benefit analysis Areas for further research
- 4. Requires validation in new areas
- 5. Requires further research on cashew apple products

2.2.11 Cashew Variety T83

TIMP Name	Cashew Variety T83
Category (technology, innovation or management practice)	Technology

A: Description of the technology, innovation or management practice	
Problem to be addressed	Decline in cashew production due to use of aged tree and over
	reliance on low yielding cashew varieties with poor kernel
	quality and long maturity
What is it? (TIMP description)	A cashew variety with the following traits: Moderate yields (30
	(5.2 m at five years old): Modium conony width (8.2 m at five
	(5.2 If at five years old), wedduil callopy widdi (6.2 if at five years old); and Orange and rounded apple
	years one,, and orange and rounded apple.
	Suitable in altitude of 10-1000m in agro-ecological zones L2
	lowland Marginal Sugarcane zone; L3 Coconut Cassava zone; L4
	Cashewnut -Cassava zone; L5 Lowland Livestock-Millet zone;
	LM5 Lower Midland Livestock-Millet zone; LM4 Marginal
	Cotton zone; LM5 Livestock-Millet zone; LM4 Marginal Cotton
	Zone; LM3 Cotton Zone
	Ottom Varial Manham Will'Common Discon Lance Taite Transfe
	Sites: Kwale, Mombasa, Kilifi, Tana River, Lamu, Taita Taveta, Vitui Maluani Tharaka Nithi Hama Day
	Kitui, Makueni, Tharaka Nitili, Homa Bay
Justification	A high vielding variety suitable in major cashew growing areas
	and with high quality kernels and short maturity duration.
B: Assessment of dissemination a	nd scaling up/out approaches
Users of TIMP	• Farmers, Extension agencies, Nursery operators, Traders, Nut
	and fruit processors, agriprenuers and Consumers
Approaches used in dissemination	• Farmer Field and Business School (FFBS)
	Agricultural innovation platforms (AIP)
	• Demonstrations - On-farm and on station
	 Agricultural shows/exhibitions/field days
	 Trainings - workshops/Seminars/Meetings
	Public and private Extension Agents
	• Farmer-to-farmer extension models
	Mass media - Electronic and print
	 Publications - posters/brochures/leaflets, manuals
	• Digital Platforms - Website, Dashboards, Apps, social media short message services
Critical/essential factors for	Participatory Implementation
successful promotion	Stakeholder capacity building
	Functioning nurseries in close to farmers
	• Stakenolder networks
Partners/stakeholders for scaling	Africa) CBOs Farmer Groups Service provider agencies
up and their respective roles.	including micro-finance agencies such as MESPT, banks, agro-
	vets, processors and manufacturers, aggregators, Nut Processors
C: Current situation and future s	caling up
Counties where already promoted	None
if any	
Counties where TIMPs will be	To be validated in Kilifi, Kwale, Lamu , Tana River, Taita Taveta,

Upscaled	Kitui, Makueni, Tharaka Nithi, Homa Bay, Kisumu, Siaya and
	Busia.
Challenges in development and	• Low interest in cashewnut production
dissemination	• Limited investment in the crop
	Limited publicity
	• Few functional local processing facilities
	Low investment in research
Suggestions for addressing the	• Educate farmers on importance of cashew production
challenges	• Strengthening cashew farmer organizations
	• Investment in crop development (research, extension,
	processing)
	• Supportive policies such as subsidization of processing
Lagong loomad in up gooling if	equipment and production inputs, ban on export of raw nuts
Lessons learned in up scanng, ii	involvement of private nursery operators, other government
any	agencies (County, KEPHIS and MOALD-AFA), Non-
	up scaling of the technology
Social environmental policy and	a Gender inclusiveness in eren research and development
market conditions necessary for	 Genuer menusiveness in crop research and development Capacity building of stakeholders
development and up-scaling	 Understanding the physical and biotic Environment in target
development and up seaming	ecologies
	• Understanding community culture preferences and
	practices
D: Economic, gender, vulnerable	and marginalized groups (VMGs) considerations
Basic costs	Cost of production KES 21,975.00
Estimated returns	Gross Margin KES 59,025.00
Gender issues and concerns in	• Women and youth have limited access to productive
development, dissemination,	resources such as land, credit, and quality seeds compared
adoption and scaling up	to men
	• Women and youth have limited access to education, training
	and extension services compared to men
	• Cashew trees are considered men's enterprises thereby
	μ_{11}
	• Man dominate decisions on cashaw at the household and
	 Men dominate decisions on cashew at the household and community.
	 Men dominate decisions on cashew at the household and community Women perform most of the weeding and processing activities
Gender related opportunities	 Men dominate decisions on cashew at the household and community Women perform most of the weeding and processing activities Opportunities for women exists in the node of nurserv
Gender related opportunities	 Men dominate decisions on cashew at the household and community Women perform most of the weeding and processing activities Opportunities for women exists in the node of nursery establishment where they can operate them as business enterprises
Gender related opportunities VMG issues and concerns in	 Men dominate decisions on cashew at the household and community Women perform most of the weeding and processing activities Opportunities for women exists in the node of nursery establishment where they can operate them as business enterprises Limited access to productive resources such as land, credit,
Gender related opportunities VMG issues and concerns in development, dissemination,	 Men dominate decisions on cashew at the household and community Women perform most of the weeding and processing activities Opportunities for women exists in the node of nursery establishment where they can operate them as business enterprises Limited access to productive resources such as land, credit, quality seeds, information on new varieties and production
Gender related opportunities VMG issues and concerns in development, dissemination, adoption and scaling up	 Men dominate decisions on cashew at the household and community Women perform most of the weeding and processing activities Opportunities for women exists in the node of nursery establishment where they can operate them as business enterprises Limited access to productive resources such as land, credit, quality seeds, information on new varieties and production techniques
Gender related opportunities VMG issues and concerns in development, dissemination, adoption and scaling up	 Men dominate decisions on cashew at the household and community Women perform most of the weeding and processing activities Opportunities for women exists in the node of nursery establishment where they can operate them as business enterprises Limited access to productive resources such as land, credit, quality seeds, information on new varieties and production techniques Limited access to training and extension services
Gender related opportunities VMG issues and concerns in development, dissemination, adoption and scaling up	 Men dominate decisions on cashew at the household and community Women perform most of the weeding and processing activities Opportunities for women exists in the node of nursery establishment where they can operate them as business enterprises Limited access to productive resources such as land, credit, quality seeds, information on new varieties and production techniques Limited access to training and extension services Due to their social status VMGs are often excluded from
Gender related opportunities VMG issues and concerns in development, dissemination, adoption and scaling up	 Men dominate decisions on cashew at the household and community Women perform most of the weeding and processing activities Opportunities for women exists in the node of nursery establishment where they can operate them as business enterprises Limited access to productive resources such as land, credit, quality seeds, information on new varieties and production techniques Limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination
Gender related opportunities VMG issues and concerns in development, dissemination, adoption and scaling up	 Men dominate decisions on cashew at the household and community Women perform most of the weeding and processing activities Opportunities for women exists in the node of nursery establishment where they can operate them as business enterprises Limited access to productive resources such as land, credit, quality seeds, information on new varieties and production techniques Limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities
Gender related opportunities VMG issues and concerns in development, dissemination, adoption and scaling up	 Men dominate decisions on cashew at the household and community Women perform most of the weeding and processing activities Opportunities for women exists in the node of nursery establishment where they can operate them as business enterprises Limited access to productive resources such as land, credit, quality seeds, information on new varieties and production techniques Limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities Low adoption by VMGs due lack of awareness
Gender related opportunities VMG issues and concerns in development, dissemination, adoption and scaling up VMG related opportunities	 Men dominate decisions on cashew at the household and community Women perform most of the weeding and processing activities Opportunities for women exists in the node of nursery establishment where they can operate them as business enterprises Limited access to productive resources such as land, credit, quality seeds, information on new varieties and production techniques Limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities Low adoption by VMGs due lack of awareness Seed sorting, potting and grafting, cottage processing and marketing
Gender related opportunities VMG issues and concerns in development, dissemination, adoption and scaling up VMG related opportunities	 Men dominate decisions on cashew at the household and community Women perform most of the weeding and processing activities Opportunities for women exists in the node of nursery establishment where they can operate them as business enterprises Limited access to productive resources such as land, credit, quality seeds, information on new varieties and production techniques Limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities Low adoption by VMGs due lack of awareness Seed sorting, potting and grafting, cottage processing and marketing. Affirmative action opportunities such as the Women and

	Youth Enterprise Fund also exists for VMGs to access
	the required credit
F. Case studies/profiles of success	stories
E. Case studies promes of success	
Success stories	• Increased uptake of KALRO cashew grafted seedlings of the
	new variety
	• Technology adoption among private players and NGOs is
	increasing
	• Individual farmers who have planted the variety and
	plantations
Application guidelines for users	1. Cashew planting guide, KALRO Mtwapa
	2. Cashew for Cash booklet, KALRO Mtwapa
	3. KALRO Cashew Nut
	https://play.google.com/store/apps/details?id=com.andromo.
	dev724321.app928007
	4. Cashew Nut Production, A reference handbook for farmers
	in Kenya, F.K. Muniu Kenya Agricultural and Livestock
	Research Organization (KALRO) Email:
	directorgeneral@kalro.org Website: www.kalro.org
	5. Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima
	Nchini Kenya, F.K. Muniu Kenya Agricultural and
	Livestock Research Organization (KALRO)
	directorgeneral@kalro.org Toyuti: www.kalro.org
F: Status of TIMP Readiness (1.	1. Ready for up scaling
Ready for up scaling: 2. Requires	
validation: 3. Requires further	
research)	
G: Contacts	
Contacts	Institute Director, KALRO –ICRI Mtwapa
	kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO, Mtwapa: F.K. Muniu, M. Menza, S. Mwashumbe, F.
6	Pole
Partner organizations and contacts	Pwani University, info@pu.ac.ke. W. Mbinda, KEPHIS. T.
C .	Kosium, AFA T. Yawa

- 1. Evaluation for tolerance to cashew powdery mildew
- 2. Validation of kernel weight and kernel processing characteristics
- 3. Cost benefit analysis Areas for further research:
- 4. Requires further research on cashew apple products
- 5. Validation of technology in new growing areas

2.2.12 Cashew Variety A47

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Category (technology, innovation or management practice)	Technology
A: Description of the technology,	innovation or management practice
Problem to be addressed	Decline in cashew production due to use of aged tree and over reliance on low yielding cashew varieties with poor kernel quality and long maturity
What is it? (TIMP description)	A cashew variety with the following traits: High yields (34 kg per tree); High nut and kernel weight (6.5 g); Low plant height (5.1 m at five years old); Medium canopy width (8.6 m at five years old); and red and conical apple. Suitable in altitude of 10-1000m in agro-ecological zones L2 lowland Marginal Sugarcane zone; L3 Coconut Cassava zone; L4 Cashewnut -Cassava zone; L5 Lowland Livestock-Millet zone; LM5 Lower Midland Livestock-Millet zone; LM4 Marginal Cotton zone; LM5 Livestock-Millet zone; LM4 Marginal Cotton Zone; LM3 Cotton Zone Sites: Kwale, Mombasa, Kilifi, Tana River, Lamu, Taita Taveta, Kitui, Makueni, Tharaka Nithi Homa
Justification B: Assessment of dissemination as	A high yielding variety suitable in major cashew growing areas and with high quality kernels and short maturity duration.
Users of TIMP	Earmers Extension agencies Nursery operators Traders Nut
	and fruit processors and Consumers
Approaches used in dissemination	 Farmer Field and Business School (FFBS) Agricultural innovation platforms (AIP) Demonstrations - On-farm and on station Agricultural shows/exhibitions/field days Trainings - workshops/Seminars/Meetings Public and private Extension Agents Farmer-to-farmer extension models
	Mass media - Electronic and print

	Publications - posters/brochures/leaflets, manuals
	• Digital Platforms - Website, Dashboards, Apps, social media short message services
Critical/essential factors for	Participatory Implementation
successful promotion	Stakeholder capacity building
r	• Functioning nurseries in close to farmers
	Stakeholder networks
Partners/stakeholders for scaling	MoALD, KEPHIS, NGOs including FA (Farm Africa, Ten Senses
up and their respective roles.	Africa), CBOs, Farmer Groups, Service provider agencies
	including micro-finance agencies such as MESPT, banks, agro-
	Association of Kenva (NutPak).
C: Current situation and future se	caling up
Counties where already promoted, if any	• None
Counties where TIMPs will be	To be validated in Kilifi, Kwale, Lamu, Tana River, Taita Taveta.
upscaled	Kitui, Makueni, Tharaka Nithi, Homa Bay, Kisumu, Siaya and
	Busia.
Challenges in development and	• Low interest in cashewnut production
dissemination	• Limited investment in the crop
	• Limited publicity
	• Few functional local processing facilities
	• Low investment in research
Suggestions for addressing the	Educate farmers on importance of cashew production
challenges	Strengthening cashew farmer organizations Investment in even development (research, extension
	• Investment in crop development (research, extension,
	 Supportive policies such as subsidization of processing
	equipment and production inputs, ban on export of raw nuts
Lessons learned in up scaling, if	Involvement of private nursery operators, other government
any	agencies (County, KEPHIS and MoALD-AFA), Non-
	governmental agencies (Tens senses), MESPT has fast tracked the
	up scaling of the technology.
	Condexis herizon in one more than the shares of
social, environmental, policy and	 Gender inclusiveness in crop research and development Capacity building of stakeholders
development and up scaling	 Capacity building of stakeholders Understanding the physical and biotic Environment in target
development and up-searing	ecologies
	• Understanding community culture preferences and
	practices
D: Economic, gender, vulnerable	and marginalized groups (VMGs) considerations
Basic costs	Cost of production KES 21,975.00
Estimated returns	Gross Margin KES 69,825.00
Gender issues and concerns in	• Women and youth have limited access to productive
development, dissemination,	resources such as land, credit, and quality seeds than men
adoption and scaling up	• Women and youth have limited access to education, training
	and extension services than men
	• Cashew trees are considered men's enterprises thereby
	limiting women control and benefit from them

	• Men dominate decisions on cashew at the household and
	community
~	• Women perform most of the weeding and processing activities
Gender related opportunities	Opportunities for women exists in the node of nursery
VMG issues and concerns in	• Limited access to productive resources such as land, credit
development dissemination	• Elimited access to productive resources such as fand, creat, quality seeds, information on new varieties and production
adoption and scaling up	techniques
	• Limited access to training and extension services
	• Due to their social status VMGs are often excluded from
	decision making in development and dissemination
	activities
	Low adoption by VMGs due lack of awareness
VMG related opportunities	• Seed sorting, potting and grafting, cottage processing
	• Affirmative action opportunities such as the Women and
	• Annihilative action opportunities such as the women and Youth Enterprise Fund also exists for VMGs to access
	the required credit
E: Case studies/profiles of success	stories
Success stories	• Increased uptake of KALRO cashew grafted seedlings of the
	new variety
	• Technology adoption among private players and NGOs is
	increasing
	• Individual farmers who have planted the variety and
Aggligation midelines for years	plantations
Application guidennes for users	1. Cashew planting guide, KALKO Miwapa 2. Cashew for Cash booklet KALRO Miwapa
	3 KALRO Cashew Nut
	https://play.google.com/store/apps/details?id=com.andromo
	.dev724321.app928007
	4. Cashew Nut Production, A reference handbook for farmers
	in Kenya, F.K. Muniu Kenya Agricultural and Livestock
	Research Organization (KALRO) Email:
	directorgeneral@kalro.org Website: <u>www.kalro.org</u>
	5. UKUZAJI BORA WA MIKOROSHO, MWONGOZO WA WAKUIIMA Nahini Kanya, E.K. Muniu Kanya Agricultural and
	Livestock Research Organization:
	directorgeneral@kalro.org Toyuti: www.kalro.org
F: Status of TIMP Readiness (1.	1. Ready for up scaling
Ready for up scaling; 2. Requires	
validation; 3. Requires further	
research)	
G: Contacts	
Contacts	Institute Director, KALRO –ICRI Mtwapa
Lead organization and scientists	KAIRO Mtwapa@Kallo.org
Lead organization and scientists	Pole
Partner organizations and contacts	Pwani University, info@pu.ac.ke. W. Mbinda, KEPHIS. T.
	Kosium, AFA T. Yawa

- 1. Evaluation for tolerance to powdery mildew
- 2. Validation of net kernel weight and kernel processing characteristics
- 3. Cost benefit analysis Areas for further research:
- 4. Requires further research on cashew apple products
- 5. Validation of technology in new growing areas

	Q. 1. V. • 4 W/411
	Cashew Variety JK411
Category (technology,	Technology
innovation or management	
practice)	
A: Description of the technology,	innovation or management practice
Problem to be addressed	Decline in cashew production due to use of aged tree and over reliance on low yielding cashew varieties with poor kernel quality and long maturity
What is it? (TIMP description)	A cashew variety with the following traits: High yields (36 kg per tree); High nut and kernel weight (5g); Low plant height (4.8 m at five years old); Low canopy width (8.5 m at five years old); and yellow and angular apples. Suitable in altitude of 10-1000m in agro-ecological zones L2 lowland Marginal Sugarcane zone; L3 Coconut Cassava zone; L4 Cashewnut -Cassava zone; L5 Lowland Livestock-Millet zone; LM5 Lower Midland Livestock-Millet zone; LM4 Marginal Cotton zone; LM5 Livestock-Millet zone; LM4 Marginal Cotton Zone; LM3 Cotton Zone Sites: Kwale, Mombasa, Kilifi, Tana River, Lamu, Taita Taveta, Kitui, Makueni, Tharaka Nithi, Homa Bay
Justification B: Assessment of dissemination and	A high yielding variety suitable for major cashew growing areas and with high quality kernels and short maturity duration.
Users of TIMP	• Farmers, Extension agencies, Nursery operators, Traders, Nut and fruit processors, Consumers and agriprenuers
Approaches used in dissemination	Farmer Field and Business School (FFBS)

2.2.13 Cashew Variety JK411

	• Agricultural innovation platforms (AIP)
	• Demonstrations - On-farm and on station
	Agricultural shows/exhibitions/field days
	Trainings - workshops/Seminars/Meetings
	Public and private Extension A conte
	Fublic and private Extension Agents
	• Farmer-to-farmer extension models
	• Mass media - Electronic and print
	• Publications - posters/brochures/leaflets, manuals
	 Digital Platforms - Website, Dashboards, Apps, social media short message services
Critical/essential factors for	Participatory Implementation
successful promotion	Stakeholder capacity building
	• Functioning nurseries in close to farmers
	Stakeholder networks
Partners/stakeholders for scaling	MoALD, KEPHIS, NGOs including FA (Farm Africa, Ten Senses
up and their respective roles.	Africa), CBOs, Farmer Groups, Service provider agencies
	including micro-finance agencies such as MESP1, banks, agro-
	Association of Kenva (NutPak)
C: Current situation and future se	caling up
Counties where already promoted.	None
if any	
Counties where TIMPs will be	To be validated in Kilifi, Kwale, Lamu , Tana River, Taita Taveta,
upscaled	Kitui, Makueni, Tharaka Nithi, Homa Bay, Kisumu, Siaya and
Challenges in development and	Busia.
discomination	• Low interest in cashewhut production
dissemination	Limited investment in the crop Limited publicity
	 Environmentational local processing facilities
	 Low investment in research
Suggestions for addressing the	Educate farmers on importance of cashew production
challenges	• Strengthening cashew farmer organizations
	• Investment in crop development (research, extension,
	processing)
	• Supportive policies such as subsidization of processing
	equipment and production inputs, ban on export of raw nuts
Lessons learned in up scaling, if	Involvement of private nursery operators, other government
any	agencies (County, KEPHIS and MoALD-AFA), Non-
	governmental agencies (Tens senses), MESPT has fast tracked the
	up scaling of the technology.
Social environmental policy and	• Gender inclusiveness in crop research and development
market conditions necessary for	 Capacity building of stakeholders
development and up-scaling	• Understanding the physical and biotic Environment in target
a company and of sources	ecologies
	• Understanding community culture, preferences, and
	practices
D: Economic, gender, vulnerable	and marginalized groups (VMGs) considerations

Estimated returnsGross Margin KES 72,225.00Gender issues and concerns in development discomination• Women and youth have limited access to productive resources such as land, credit, and quality seeds than man	
Gender issues and concerns in • Women and youth have limited access to productive resources such as land, gradit, and quality goads than man	
 adoption and scaling up Women and youth have limited access to education, training and extension services than men Cashew trees are considered men's enterprises thereby limiting women control and benefit from them Men dominate decisions on cashew at the household and community Wemen perform most of the weading and processing activity 	
Gender related opportunities Opportunities for women exists in the node of nurs	ery
 establishment where they can operate them as business enterprint establishment where they can operate them as business enterprint establishment where they can operate them as business enterprint establishment where they can operate them as business enterprint establishment where they can operate them as business enterprint establishment where they can operate them as business enterprint establishment where they can operate them as business enterprint establishment where they can operate them as business enterprint establishment where they can operate them as business enterprint establishment where they can operate them as business enterprint establishment where they can operate them as business enterprint establishment where they can operate them as business enterprint establishment where they can operate them as business enterprint establishment where they can operate them as business enterprint establishment establishmenterpresent establishment establishment establishment establis	,
 Low adoption by VMGs due tack of awareness VMG related opportunities Seed sorting, potting and grafting, cottage processing and marketing. Affirmative action opportunities such as the Women and Youth Enterprise Fund also exists for VMGs to access the required credit 	
E: Case studies/profiles of success stories	
 Success stories Increased uptake of KALRO cashew grafted seedlings of the new variety Technology adoption among private players and NGOs is increasing Individual farmers who have planted the variety and plantations 	he s
Application guidelines for users 1. Cashew planting guide, KALRO Mtwapa 2. Cashew for Cash booklet, KALRO Mtwapa 3. KALRO Cashew Nut https://play.google.com/store/apps/details?id=com.andro.dev724321.app928007 4. Cashew Nut Production, A reference handbook for farm in Kenya, F.K. Muniu Kenya Agricultural and Livestock Research Email: directorgeneral@kalro.org Website: www.kalro.org, 5. Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima Nchini Kenya, F.K. Muniu Kenya Agricultural and Livestock Research Organisation Barua Pepe: directorgeneral@kalro.org Tovuti: www.kalro.org	omo ers
r: Status of FIMP Keadiness (1. 1. Keady for up scaling	
validation: 3. Requires further	

research)	
G: Contacts	
Contacts	Institute Director, KALRO –ICRI Mtwapa
	kalro.mtwapa@kalro.org
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	Pole
Partner organizations and contacts	Pwani University, info@pu.ac.ke - W. Mbinda; KEPHIS - T.
	Kosium; AFA - T. Yawa

- 1. Evaluation for tolerance to powdery mildew
- 2. Validation of net kernel weight and kernel processing characteristics
- 3. Cost benefit analysis Areas for further research:
- 4. Requires further research on cashew apple products
- 5. Validation of technology in new growing areas

2.2.14 Cashew Variety MT10

TIMP Name	Cashew Variety MT10
Category (technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Decline in cashew production due to use of aged tree and over reliance on low yielding cashew varieties with poor kernel quality and long maturity
What is it? (TIMP description)	A cashew variety with the following traits: High yields (36 kg per tree); High nut and kernel weight (4 g); Medium plant height (6.4 m at five years old); Medium canopy width (9 m at five years old); and red and angular apple. Suitable in altitude of 10-1000m in agro-ecological zones L2 lowland Marginal Sugarcane zone; L3 Coconut Cassava zone; L4 Cashewnut -Cassava zone; L5 Lowland Livestock-Millet zone; LM5 Lower Midland Livestock-Millet zone; LM4 Marginal Cotton zone; LM5 Livestock-Millet zone; LM4 Marginal Cotton Zone; LM3 Cotton Zone

	Sites: Kwale, Mombasa, Kilifi, Tana River, Lamu, Taita Taveta, Kitui, Makueni, Tharaka Nithi, Homa Bay
Justification	A high yielding variety suitable in major cashew growing areas and with high quality kernels and short maturity duration.
B: Assessment of dissemination and	nd scaling up/out approaches
Users of TIMP	• Farmers, Extension agencies, Nursery operators, Traders, Nut and fruit processors, agriprenuers and Consumers
Approaches used in dissemination	 Farmer Field and Business School (FFBS) Agricultural innovation platforms (AIP) Demonstrations - On-farm and on station Agricultural shows/exhibitions/field days Trainings - workshops/Seminars/Meetings Public and private Extension Agents Farmer-to-farmer extension models Mass media - Electronic and print Publications - posters/brochures/leaflets, manuals Digital Platforms - Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	 Participatory Implementation Stakeholder capacity building Functioning nurseries in close to farmers Stakeholder networks
Partners/stakeholders for scaling up and their respective roles.	MoALD, KEPHIS, NGOs including FA (Farm Africa, Ten Senses Africa), CBOs, Farmer Groups, Service provider agencies including micro-finance agencies such as MESPT, banks, agro- vets, processors and manufacturers, aggregators, Nut Processors Association of Kenya (NutPak)
C: Current situation and future s	caling up
Counties where already promoted. if any	None
Counties where TIMPs will be up-scaled	To be validated in Kilifi, Kwale, Lamu ,Tana River, Taita Taveta, Kitui, Makueni, Tharaka Nithi, Homa Bay, Kisumu, Siaya and Busia.
Challenges in development and dissemination	 Low interest in cashewnut production Limited investment in the crop Limited publicity Few functional local processing facilities Low investment in research
Suggestions for addressing the challenges	 Educate farmers on importance of cashew production Strengthening cashew farmer organizations Investment in crop development (research, extension, processing) Supportive policies such as subsidization of processing equipment and production inputs, ban on export of raw nuts
Lessons learned in up scaling, if any	Involvement of private nursery operators, other government agencies (County, KEPHIS and MoALD-AFA), Non-

	governmental agencies (Tens senses), MESPT has fast tracked the up scaling of the technology.	
Social, environmental, policy and market conditions necessary for development and up-scaling	 Gender inclusiveness in crop research and development Capacity building of stakeholders Understanding the physical and biotic Environment in target ecologies Understanding community culture, preferences, and practices 	
D: Economic, gender, vulnerable	and marginalized groups (VMGs) considerations	
Basic costs	Cost of production KES 21,975.00	
Estimated returns	Gross Margin KES 75,225.00	
Gender issues and concerns in development, dissemination, adoption and scaling up	 Women and youth have limited access to productive resources such as land, credit, and quality seeds than men Women and youth have limited access to education, training and extension services than men Cashew trees are considered men's enterprises thereby limiting women control and benefit from them Men dominate decisions on cashew at the household and community Women perform most of the weeding and processing activities 	
Gender related opportunities	Opportunities for women exists in the node of nursery establishment where they can operate them as business enterprises	
VMG issues and concerns in development, dissemination, adoption and scaling up	 Limited access to productive resources such as land, credit, quality seeds, information on new varieties and production techniques Limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities Low adoption by VMGs due lack of awareness 	
VMG related opportunities	 Seed sorting, potting and grafting, cottage processing and marketing. Affirmative action opportunities such as the Women and Youth Enterprise Fund also exists for VMGs to access the required credit 	
E: Case studies/profiles of success stories		
Success stories	 Increased uptake of KALRO cashew grafted seedlings of the new variety Technology adoption among private players and NGOs is increasing Individual farmers who have planted the variety and plantations Cashew planting guide, KALRO Mtwapa 	
Appleation guidelines for users	 Cashew planning guide, ici iLico intwapa Cashew for Cash booklet, KALRO Mtwapa KALRO Cashew Nut <u>https://play.google.com/store/apps/details?id=com.andromo</u> .dev724321.app928007 	

F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research) C: Contacts	 4. Cashew Nut Production, A reference handbook for farmers in Kenya, F.K. Muniu Kenya Agricultural and Livestock Research Organization Email: directorgeneral@kalro.org Website: www.kalro.org 5. Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima Nchini Kenya, F.K. Muniu Kenya Agricultural and Livestock Research Organization Barua Pepe: directorgeneral@kalro.org Tovuti: www.kalro.org Ready for up scaling
Contacts	Institute Director KALRO – ICRI Mtwapa
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	Pole
Partner organizations and contacts	Pwani University, info@pu.ac.ke. W. Mbinda, KEPHIS, T.
	Kosium, AFA T. Yawa

- Evaluation for tolerance to cashew powdery mildew 1.
- Validation of kernel weight and kernel processing characteristics Cost benefit analysis Areas for further research: 2.
- 3.
- Requires further research on cashew apple products 4.
- Validation of technology in new growing areas and top-working 5.

2.3 Cashew Seed System

2.3.1 Cashew propagation through wedge grafting

TIMP Name	Cashew propagation through wedge grafting
Category (technology, innovation or management practice)	Technology
A: Description of the technology,	innovation or management practice
Problem to be addressed	Long maturity duration, yield variation and low production (5-7 years) for trees sown from seed while those established from grafted seedlings take 2-3 years
What is it? (TIMP description)	Making of an artificial union between two plants of the same family so that they unite and grow as one plant. These parts are the rootstock and a scion. Selection of scions from suitable varieties is done during early hours in the morning. The actively growing part of the rootstock is cut and removed leaving two functional leaves. A wedge shaped vertically cut of 2-3cm is made down the stock between the two leaves. A matching wedge cut of the scion of a similar length is made. The scion is inserted to the rootstock and tied together with a grafting tape.
Justification	Grafted Cashew seedlings take shorter duration of 2-3 years to mature and produce uniformly, while trees sown from seed take 5-7 years)with variable growth and production
B: Assessment of dissemination a	nd scaling up/out approaches
Users of TIMP	Nursery operators, Cashew growers, Extension agencies and Traders
Approaches used in dissemination	 Farmer Field and Business School (FFBS) Agricultural innovation platforms (AIP) Demonstrations - On-farm and on station Agricultural shows/exhibitions/field days Trainings - workshops/Seminars/Meetings Public and private Extension Agents Farmer-to-farmer extension models

	Mass media - Electronic and print
	• Publications - posters/brochures/leaflets, manuals
	Digital Platforms - Website, Dashboards, Apps, social media short
	message services
Critical/essential factors for	• Skilled service providers
successful promotion	• Availability of improved varieties (scions)
	• Preferred varieties by farmers and processors
Partners/stakeholders for scaling	• KALRO - Avail scions from improved cashew varieties and
up and their respective roles.	trainings
	• Universities - Technical backstopping
	• Kenya Plant Health Inspectorate Services (KEPHIS) - Seed
	inspection
	• CBOs, NGO's - Seedlings multiplication and technology
	dissemination
	• Nursery operators - Seedlings multiplication
C: Current situation and future so	caling up
Counties where already promoted.	Kilifi, Kwale, Tana River, Tharaka Nithi and Lamu
if any	
Counties where TIMPs will be up	Kilifi, Kwale, Tana River, Tharaka Nithi and Lamu
scaled	
discomination	• Limited number of skilled grafters
dissemination	• Limited funding
	• Unpredictability of demand of cashew seedlings by farmers
	aue to erratic weather
Suggestions for addressing the	Enificed access to granting tools and equipments Puild conscitute of private sector players and NGOs to help
challenges	in dissemination
	Avail funds
	 Involvement of agro-dealers and stockists of agricultural
	inputs
Lessons learned in up scaling, if	Involvement of private nursery operators, other government
any	agencies (County, KEPHIS and MoALD-AFA), Non-
	governmental agencies (Tens senses), MESPT has fast tracked the
	up scaling of the technology.
Social, environmental, policy and	• Adequate capacity of growers to acquire grafted seedlings
market conditions necessary for	• Geographical distribution of nursery operators and transport
development and up-scaling	network
	 Registered and licensed nursery operators
	 Access to suitable financing by nursery operators
	 Supportive policies and regulations –licences and levies
D: Economic, gender, vulnerable	and marginalized groups (VMGs) considerations
Basic costs	Estimated cost: KES 34.00 per seedling
Estimated returns	Estimated cost: KES 26.00 per seedling
Gender issues and concerns in	Increased work burden for women when grafting
development, dissemination,	• Women and youth have limited access to credit for use in
adoption and scaling up	buying farm implements than men

	• Women and youth have limited access to education training
	and extension services than men
	 Cashew trees are considered men's enterprises thereby
	limiting women control and benefit from them
	 Men dominate decisions on cashew at the household and
	community
Gender related opportunities	Opportunities for women exists in the node of nursery
Sender Tended opportainties	establishment where they can operate them as business enterprises
VMG issues and concerns in	• Limited access to productive resources such as land, credit,
development, dissemination,	and quality seeds
adoption and scaling up	 Limited access to training and extension services
	• Due to their social status VMGs are often excluded from
	decision making in development and dissemination
	activities
	• VMGs have limited access to seed and information on new
	varieties and production techniques
	• There is low adoption by VMGs due lack of
	awareness
VMG related opportunities	• Seed sorting, potting and grafting
	• Affirmative action opportunities such as the women and
	youth enterprise fund exists for VMGs to access the
	required credit.
E: Case studies/profiles of success	stories
Success stories	• Increased uptake of KALRO cashew grafted seedlings of the
	new varieties
	• Technology adoption among private players and NGOs is
	increasing
	• Individual farmers who have planted new varieties and
	plantations
Application guidelines for users	1. Cashew planting guide, KALRO Mtwapa
	2. Cashew for Cash booklet, KALRO Mtwapa
	3. KALRO Cashew Nut
	https://play.google.com/store/apps/details?id=com.andromo.
	<u>dev724321.app928007</u>
	4. Cashew Nut Production, A reference handbook for farmers
	in Kenya, F.K. Muniu Website: www.kalro.org
	5. Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima
	Nchini Kenya, F.K. Muniu 6 Mobile app on casheyy propagation - KALBO website
F. Status of TIMP Boadiness (1	1 Ready for up scaling
F. Status of Thyli Keaumess (1. Ready for up scaling: 2 Requires	1. Ready for up scaling
validation: 3 Requires further	
research)	
G: Contacts	
Contacts	Institute Director KALRO_ICRI Mtwapa
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	KALRO Matuga, F. Pole
Partner organizations and contacts	Pwani University, info@pu.ac.ke.S - Muti H. Saha:

		Coast Development Authority J. Kombe
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- 1. Validation of appropriate rootstocks including compatibility trials
- 2. There is need to validate appropriate scion packaging and transportation methods particularly for long distances
- 3. Fine-tune application as a complementary technology in coppicing and top-working
- 4. Requires further research

2.3.2 Raising Cashew Rootstock for grafting

TIMP Name	Raising Cashew Rootstock for grafting
Category (technology,	Technology
innovation or managemen	t
practice) A. Description of the tec	hnology innovation or management practice
Problem to be addressed	Poor quality and weak seedlings production that take long to attain maturity
What is it? (TIMD	Selection of healthy goods from reising rootstock through alimination of
description)	diseased immature damaged and weak cashey seeds before planting potting
description)	The process involves sorting the seeds visually by water (floatation test) and
	using sandy soils (pre-germination) The pre-germinated seeds are transplanted
	into potting bags when the radicals (tap root) are $2.5-3$ cm after 7-10 days
	nito poting ougs when the functions (up foot) are zero bein after (foot)
	A State of the sta
	Process of raising cashew rootstock
Justification	A healthy and strong rootstock is required for successful cashew grafting.
	Rootstock provides anchorage and transportation of nutrients.
B: Assessment of dissem	ination and scaling up/out approaches
Users of TIMP	Nursery operators, Cashew growers, Extension agencies and Traders
Approaches used in	Farmer Field and Business School (FFBS)
dissemination	Agricultural innovation platforms (AIP)
	Demonstrations - On-farm and on station
	Agricultural shows/exhibitions/field days
	Trainings - workshops/Seminars/Meetings
	Public and private Extension Agents
	Farmer-to-farmer extension models
	Mass media - Electronic and print
	Publications - posters/brochures/leaflets. manuals
	Digital Platforms - Website, Dashboards. Apps. social media short
	message services
Critical/essential factors	• Skilled service providers

for successful promotion	Availability of local cashew accessions
	Preferred varieties by farmers and processors
Partners/stakeholders for	KALRO - Trainings
scaling up and their	Universities - Technical backstopping
respective roles.	• Kenya Plant Health Inspectorate Services (KEPHIS) - Seed
	inspection
	CBOs, NGOs - Seedlings multiplication and technology
	dissemination
	Nursery operators - Seedlings multiplication
C: Current situation and	future scaling up
Counties where already	Kilifi, Kwale, Tana River, Tharaka Nithi and Lamu
promoted, if any	
will be up scaled	Kilifi, Kwale, Tana River, Tharaka Nithi and Lamu
Challenges in	• Limited number of skilled grafters
development	Limited funding
and dissemination	 Unpredictability of demand of cashew seedlings by farmers due to
	erratic weather
	 Limited access to grafting tools and equipments
Suggestions for	• Build capacity of private sector players and NGOs to help in
addressing	dissemination
the challenges	Avail funds
	• Involvement of agro-dealers and stockists of agricultural inputs
Lessons learned in up	Involvement of private nursery operators, other government agencies
scaling, if any	(County, KEPHIS and MoALD-AFA), Non-governmental agencies (Tens
	senses), MESPT has fast tracked the up scaling of the technology.
Social anvironmental	
policy and market	 Adequate capacity to growers Capacity distribution of numbers operators and transport
conditions necessary for	Geographical distribution of nursery operators and transport network
development and up-	 Registered and licensed nursery operators
scaling	 Access to suitable financing by pursery operators
6	 Access to suitable financing by nursely operators Supportive policies and regulations licences and levies
D: Economic, gender, vu	Inerable and marginalized groups (VMGs) considerations
Basic costs	Estimated cost: KES 22.00 per seedling
Estimated returns	Estimated cost: KES 18 00 per seedling
Conder issues and	Increased work burden for women when raising rootstock Women
concerns in development	• Increased work burden for women when faising footstock women and youth have limited access to credit used to huy farm
disse	implements than men
mination adoption and	 Women and youth have limited access to education, training and
scaling up	extension services than men
	• Cashew trees are considered men's enterprises thereby limiting
	women control and benefit from them
	• Men dominate decisions on cashew at the household and
	community
Gender related	Opportunities for women exists in the node of nursery establishment where
opportunities	they can operate them as business enterprises

VMG issues and concerns in development, disse mination, adoption and scaling up	 Limited access to productive resources such as land, credit, and quality seeds Limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities VMGs have limited access to seed and information on new varieties
	 and production techniques There is low adoption by VMGs due lack of awareness
VMG related opportunities	 VMGs have opportunities in seed sorting, potting and grafting Affirmative action opportunities such as the women and youth enterprise fund exists for VMGs to access the required credit.
E: Case studies/profiles of	f success stories
Success stories	 Increased uptake of KALRO cashew grafted seedlings Technology adoption among private players and NGOs is increasing
Application guidelines for users	 Cashew planting guide, KALRO Mtwapa Cashew for Cash booklet, KALRO Mtwapa KALRO Cashew Nut https://play.google.com/store/apps/details?id=com.andromo.dev724321 .app928007 Cashew Nut Production, A reference handbook for farmers in Kenya, F.K. Muniu Website: www.kalro.org Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima Nchini Kenya, F.K. Muniu Mobile app on cashew propagation –KALRO website
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	• Ready for up scaling
G: Contacts	
Contacts	Institute Director, KALRO – ICRI Mtwapa Kalro.Mtwapa@kalro.org
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Partner organizations and contacts	Pwani University, info@pu.ac.ke.S Muti H. Saha; Coast Development Authority J. Kombe

- 1. Validation of appropriate rootstocks including compatibility trials
- 2. There is need to validate appropriate scion packaging and transportation methods particularly for long distances
- 3. Requires validation in other areas
- 4. Requires further research

2.4 Cashew Agronomic Management Practices

2.4.1 Cashew spacing recommendations

Category (technology, innovation or management practice) A: Description of the technology, innovation or management practice Problem to be addressed Competition for nutrients due to overcrowding and intermingling trees. What is it? (TIMP description) Establishment of cashew orchards at appropriate spacing of 12 metres in CL3, 10 metres x 10 metres in CL4. Justification Low productivity because cashew trees are randomly planted at close spacing resulting in overcrowding and intermingling of canopy, poor light penetration and difficult to conduct management practices such as pruning and weeding. Overcrowding increases spread of pests and diseases. B: Assessment of dissemination and scaling up/out approaches Cashew growers, Public and private extension service providers Approaches used in dissemination - Gashew growers, Public and private extension service providers Approaches used in dissemination - Agricultural innovation platforms (AP) • Demonstrations - On-farm and on station - Agricultural shows/exhibitions/field days • Farmer-to-farmer extension models • Mass media - Electronic and print • Public ican - py costers/brochures/leaflets, manuals Digital Platforms - Website, Dashboards, Apps, social media short message services Critical/essential factors for successful Stilled services revisities - Technical backstopping Partners/stakeholders for scaling up and extension education • KALRO - Trainings <	TIMP Name	Cashew spacing recommendations
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 and their Universities - Technical backstopping Kenya Plant Health Inspectorate Services (KEPHIS) - Seed inspection CBOs, NGOs - Seedlings multiplication and technology dissemination Nursery operators - Seedlings multiplication Extension workers - Dissemination and technical backstopping C: Current situation and future scaling up 	Partners/stakeholders for scaling up	KALRO - Trainings
 Kenya Plant Health Inspectorate Services (KEPHIS) - Seed inspection CBOs, NGOs - Seedlings multiplication and technology dissemination Nursery operators - Seedlings multiplication Extension workers - Dissemination and technical backstopping C: Current situation and future scaling up 	and their	Universities - Technical backstopping
 Seed Inspection CBOs, NGOs - Seedlings multiplication and technology dissemination Nursery operators - Seedlings multiplication Extension workers - Dissemination and technical backstopping C: Current situation and future scaling up 	respective roles.	• Kenya Plant Health Inspectorate Services (KEPHIS) -
 CBOS, NGOS - Seedings multiplication and technology dissemination Nursery operators - Seedlings multiplication Extension workers - Dissemination and technical backstopping C: Current situation and future scaling up 		Seed inspection
		CBOS, NGOS - Seedings multiplication and technology dissemination
Extension workers - Dissemination and technical backstopping C: Current situation and future scaling up		 Nursery operators - Seedlings multiplication
C: Current situation and future scaling up		 Extension workers - Dissemination and technical
C: Current situation and future scaling up		backstopping
	C: Current situation and future scal	ing up

Counties where already promoted, if any	Kilifi, Kwale, Tana River and Lamu
Counties where TIMPs will be upscaled	Kilifi, Kwale, Tana River and Lamu
Challenges in development and	Inadequate service providers
dissemination	Land ownership challenges
	Limited extension services
Suggestions for addressing the	 Training growers and service providers
challenges	Streamline land tenure system
	Encourage more participation of NGOs/private
	partnerships
Lessons learned in up scaling, if any	• Availability of Cost benefit information enhances
	adoption
	Well-spaced trees are manageable
Social, environmental, policy and	The technology is socially acceptable and environmentally
market conditions necessary for	friendly because it involves planting of new trees at
development and up- scaling	higher yields
	The returns from the new orchards with improved varieties
	and grafted are much higher than those from aged trees
	haphazardly planted
D: Economic, gender, vulnerable an	d marginalized groups (VMGs) considerations
Basic costs	Costs for string and tape measure for field lay out are minimal
Estimated returns	Cash returns:1 tree at 8 years old yields at above 30 Kg
	of raw @ $150 = \text{KES} 4500/\text{tree}$
	Intangible benefits from trees: environmental conservation - preserving water catchments
Gender issues and concerns in	• Cutting the old huge trees can increase women burden
development, dissemination, adoption	• Women and youth have limited access to productive
and scaling up	resources such as land, credit, and quality seeds than
	men
	• Women and youth have limited access to education,
	training and extension services than men
	• Cashew trees are considered men's enterprises thereby
	limiting women control and benefit from them
	• Men dominate decisions on cashew at the household
	and community
Gender related opportunities	Opportunities for women exists in the node of nursery
	establishment where they can operate them as business
VMC issues and concerns in	enterprises
development dissemination adoption	
actorophicht, absolinnation, adoption	• Limited access to productive resources such as fand, credit, and quality seeds
and scaling up	 Limited access to productive resources such as fand, credit, and quality seeds Limited access to training and extension services
and scaling up	 Limited access to productive resources such as fand, credit, and quality seeds Limited access to training and extension services Due to their social status VMGs are often excluded
and scaling up	 Limited access to productive resources such as fand, credit, and quality seeds Limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and
and scaling up	 Limited access to productive resources such as fand, credit, and quality seeds Limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities
	Limited access to seed and information on new
--	--
	varieties and production techniques
	• There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities for employment exist for youths as
	service providers in replanting operations
E: Case studies/profiles of success st	ories
Success stories	Increased productivity among growers who adopted the practice in Kilifi, Kwale and Lamu Counties
Application guidelines for users	1. Cashew planting guide, KALRO Mtwapa
	2. Cashew for Cash booklet, KALRO Mtwapa
	3. KALRO Cashew Nut
	https://play.google.com/store/apps/details?id=com.and romo.dev724321.app928007
	Cashew Nut Production, A reference handbook for farmers in
	Kenya, F.K. Muniu Website: www.kalro.org
	Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima
	Nchini Kenya, F.K. Muniu
	Top. Soil Sub. Soil
F: Status of TIMP Readiness (1.	1. Ready for up scaling
Ready for up scaling; 2. Requires validation; 3. Requires further	
C: Contacts	
G: Contacts	
Contacts	Kalro.Mtwapa@kalro.org
Lead organization and scientists	1. KALRO, Mtwapa: F. Muniu, M. Menza, S.
	Mwashumbe
	2. KALRO Matuga, F. Pole
Partner organizations and contacts	1. Pwani University, <u>info@pu.ac.ke.S</u> - Muti H. Saha Coast Development Authority J. Kombe

- 1. Validate spacing recommendations in new growing areas (Tharaka Nithi)
- 2. Further research on appropriate intercropping systems

2.4.2 Cashew Pruning

TIMP Name	Cashew Pruning
Category (technology, innovation or management practice)	Management practice
A: Description of the technology, in	novation or management practice
Problem to be addressed	Interlocking canopies and excessive branching in cashew orchards
What is it? (TIMP description)	Pruning involves removal of interlocking, low lying, diseased, damaged, dead and unproductive branches of a mature cashew tree; cutting of the apical bud of the young tree at 1 metre to allow the tree to spread; and removal of all branches below 0.6 m above the ground for the young trees.
Justification	Pruned trees allows light penetration, reduce pest and disease incidences and result in manageable canopy and easy of harvesting.
B: Assessment of dissemination and	scaling up/out approaches
Users of TIMP	Cashew growers, public and private extension service providers
Approaches used in dissemination	 Farmer Field and Business School (FFBS) Agricultural innovation platforms (AIP) Demonstrations - On-farm and on station Agricultural shows/exhibitions/field days Trainings - workshops/Seminars/Meetings Public and private Extension Agents Farmer-to-farmer extension models Mass media - Electronic and print Publications - posters/brochures/leaflets, manuals Digital Platforms - Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	Skilled service providers; availability of affordable tools and Equipments or pruning, Use of appropriate tools and equipments
Partners/stakeholders for scaling up and their respective roles.	 KALRO - Trainings Universities - Technical backstopping Kenya Plant Health Inspectorate Services (KEPHIS) - Seed inspection CBOs, NGOs - Seedlings multiplication and technology dissemination

	Nursery operators - Seedlings multiplication
	• Extension workers - Dissemination and technical
	backstopping
C: Current situation and future scal	ing up
Counties where already promoted, if any	Kilifi, Kwale, Tana River and Lamu
Counties where TIMPs will be upscaled	Kilifi, Kwale, Tana River and Lamu
Challenges in development and	Inadequate service providers
dissemination	Limited Expertise in pruning
	Limited financial capacity among growers
Suggestions for addressing the	• Training more experts in pruning
challenges	Encourage more participation of NGOs/private partnerships
	Resources availed for procurement pruning equipments
Lessons learned in up scaling, if any	Pruned trees are easy to manage and give more yields compared to unpruned trees.
Social, environmental, policy and	The technology requires adequate sensitization
market conditions necessary for	
development and	
D: Economic, gender, vulnerable an	d marginalized groups (VMGs) considerations
Basic costs	KES 500 per tree
Estimated returns	a) Intangible benefits from trees: i) environmental
	conservation - preserving water catchments ii) Carbon
	b) Enhanced financial returns due to improved productivity
Gender issues and concerns in	Limited ownership and control of land among women
development, dissemination adoption	can limit their participation
and scaling up	• Labour intensity in pruning tall trees can be prohibitive
	for women
	• Limited access to capital among women can limit their participation
	 Bias in training opportunities in favour of men on
	providing pruning services
Gender related opportunities	Tree size is reduced through pruning making management
	operations such as spraying, and harvesting easy for women
VMG issues and concerns in	Limited access to technical training opportunities among
development, dissemination, adoption	VMGs
and scaling up	Trace size is reduced through propring making
VMG related opportunities	• The size is reduced unrough prunning making management operations such as spraying, and
	harvesting easy for women, youth and vulnerable
	persons.
	• Suitable for the youth who become self-employed as
	service providers in spraying and pruning
	Affirmative action opportunities such as the women
	and youth enterprise fund exists for VMGs to access

	the required credit to procure implements for pruning
	e.g. power saws, pruning saws
E: Case studies/profiles of success st	ories
Success stories	Increased productivity among growers who adopted the practice in Kilifi, Kwale and Lamu Counties
Application guidelines for users	 Cashew planting guide, KALRO Mtwapa Cashew for Cash booklet, KALRO Mtwapa KALRO Cashew Nut https://play.google.com/store/apps/details?id=com.andro mo.dev724321.app928007 Cashew Nut Production, A reference handbook for farmers in Kenya, F.K. Muniu Website: www.kalro.org Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima Nchini Kenya, F.K. Muniu
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	1. Ready for up scaling
G: Contacts	
Contacts	Institute Director, KALRO –ICRI Mtwapa kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO, Mtwapa: F. Muniu, M. Menza, S. Mwashumbe F. Pole kalro.mtwapa@kalro.org
Partner organizations and contacts	Pwani University, info@pu.ac.ke. W. Mbinda, H. Saha.

- 1. Validate efficacy of recommended fungicides in new growing areas (Tharaka Nithi)
- 2. Requires validation in new areas
- Upscale sensitization, training and regulation of agrochemical dealers for effective service provision

2.4.3 Cashew coppicing

TIMP Name	Cashew coppicing
Category (technology, innovation	Technology
or management practice)	
A: Description of the technology, in	novation or management practice
Problem to be addressed	Unproductive and old trees in the orchards
What is it? (TIMP description)	Coppicing is rejuvenating of aging and unproductive cashew trees through cutting the stump at 1.5m above the ground to allow growth of numerous active growing shoots which will start production of high quality nuts after one year.
Justification	Over 90% of cashew trees are aged, of low production and are producing low quality nuts. They also act as host and sources of pests and diseases that attack newly established trees.

B: Assessment of dissemination and	scaling up/out approaches
Users of TIMP	Cashew growers, Public and private extension service
Approaches used in dissemination	Farmer Field and Business School (FFBS)
	Agricultural innovation platforms (AIP)
	• Demonstrations - On-farm and on station
	Agricultural shows/exhibitions/field days
	• Trainings - workshops/Seminars/Meetings
	Public and private Extension Agents
	• Farmer-to-farmer extension models
	• Mass media - Electronic and print
	• Publications - posters/brochures/leaflets, manuals
	• Digital Platforms - Website, Dashboards, Apps, social
	media short message services
Critical/essential factors for successful promotion	Skilled service providers; availability of improved varieties, demonstrations
Partners/stakeholders for scaling up	KALRO - Trainings
and their respective roles.	Universities - Technical backstopping
	• Kenya Plant Health Inspectorate Services (KEPHIS) -
	Seed inspection
	• CBOs, NGOs - Seedlings multiplication and technology
	dissemination
	Nursery operators - Seedlings multiplication
	• Extension workers - Dissemination and technical
C. Current situation and future good	backstopping
C: Current situation and future sca	Ing up
if any	Kiim, Kwale, and Lamu
Counties where TIMPs will be upscaled	Kilifi, Kwale, Lamu Counties
Challenges in development and	Inadequate service providers
dissemination	Land ownership challenges
	• Tree ownership challenges due to tree tenure system in
	some areas.
	Limited financial capacity among growers
Suggestions for addressing the	Upscale training services
challenges	Training more experts
	• Streamline land tenure system
	Encourage more participation of
· · · · · · · · · · · · · · · · · · ·	NGOs/private partnerships
Lessons learned in up scaling, if any	Availability of Cost benefit information
	ennances adoption
	Gradual change of cycle of aged trees through copping is more effective

Social, environmental, policy and market conditions necessary for development and up-scaling	 The technology is socially acceptable and environmentally friendly because it involves rejuvenating aged trees Replacement of unproductive aged trees with new sprouted stumps The returns from the rejuvenated trees, are much higher than those from aged trees Reduces loss of cashew trees to logging since the old tree is removed leaving a stump for regeneration. The old wood obtained from coppicing can be used for timber wood fuel and other economic purposes
Basic costs	Cost of coppicing- is low. 100/- per tree
Estimated returns	Cash returns: 1 tree yields $60 \text{ kg} = 100 - \text{KES} 6.000/\text{tree}$
	Intangible benefits from trees: i) environmental conservation- preserving water catchments; ii) Carbon sequestration, addressing global warming
Gender issues and concerns in development, dissemination adoption and scaling up	 Limited ownership and control of land among women can limit their participation Labour intensity in cutting old huge trees can be prohibitive for women Limited access to capital among women can limit their participation Bias in training opportunities in favour of men on coppicing and top-working
Gender related opportunities	 Ease of participation of women since the technology does not require extensive land area. Reduced tree sizes makes the cashew production system more amenable to intercropping thereby boosting food and nutritional security and incomes among VMGs.
development, dissemination, adoption and scaling up	VMGs
VMG related opportunities	 Tree size is reduced through the technology making management operations such as spraying, pruning and harvesting easy for women, youth and vulnerable persons. Offers employment opportunities for VMGs as service providers Affirmative action opportunities such as the women and youth enterprise fund exists for VMGs to access the required credit to procure implements for coppicing e.g. power saws, pruning saws.
E: Case studies/profiles of success s	tories
Success stories	 Increased uptake of KALRO cashew rehabilitation technology Technology adoption among private players and NGOs is

	increasing
Application guidelines for users	
F: Status of TIMP Readiness (1.	1. Ready for up scaling
Ready for up scaling; 2. Requires	
validation; 3. Requires further	
research)	
G: Contacts	
Contacts	Institute Director, KALRO –ICRI Mtwapa
	kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO, Mtwapa: F. Muniu, M. Menza, S. Mwashumbe F.
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	Coast Development Authority J. Kombe

- Requires validation in new ares
 Requires further research

Cashew top-working 2.4.4

TIMP Name	Cashew top-working	
Category (technology, innovation	Technology	
A: Description of the technology, in	novation or management practice	
Problem to be addressed	Low yielding varieties in orchards.	
What is it? (TIMP description)	Top working is grafting of established trees, with an aim to upgrade or changing unproductive variety. The tree is cut down at 1.5 m above the ground awaiting sprouting of the shoots which are grafted with the scions of a high yielding variety. It is also a practice of conversion of the established orchard without uprooting the entire tree.	
Justification	Over 90% of cashew trees are local accession with low yields and low-quality nuts. These trees can be changed to high yielding trees through top working.	
B: Assessment of dissemination and scaling up/out approaches		
Users of TIMP	Cashew growers, Public and private extension service providers	
Approaches used in dissemination	• Farmer Field and Business School (FFBS)	
	Agricultural innovation platforms (AIP)	
	• Demonstrations - On-farm and on station	
	Agricultural shows/exhibitions/field days	
	• Trainings - workshops/Seminars/Meetings	

	Public and private Extension Agents
	• Farmer-to-farmer extension models
	• Mass media - Electronic and print
	• Publications - posters/brochures/leaflets_manuals
	Digital Platforms - Website Dashboards Apps social media
	short message services
Critical/essential factors for	Skilled service providers; availability of improved varieties
successful promotion	Service providers, demonstrations
Partners/stakeholders for scaling up	KALRO - Trainings
and	Universities - Technical backstopping
Their respective roles.	• Kenya Plant Health Inspectorate Services (KEPHIS) -
	Seed inspection
	• CBOs, NGOs - Seedlings multiplication and technology
	dissemination
	Nursery operators - Seedlings multiplication
	Extension workers - Dissemination and technical backstopping
C: Current situation and future sca	ing up
Counties where already promoted	Kilifi Kwale and Lamu
if	
Any	
Counties where TIMPs will be upscaled	Kilifi, Kwale, and Lamu
Challenges in development and	Inadequate service providers
dissemination	• Limited grafting and top-working experts
	Land ownership challenges
	Limited financial capacity among growers
Suggestions for addressing the	• Upscale training services
challenges	• Training more experts in grafting
	Encourage more participation of NGOS/private portnorships
Lessons learned in up scaling, if any	Availability of Cost benefit information enhances
Lessons rearred in up searing, it any	adoption
	Gradual change of cycle of aged trees of unknown
	varieties through topworking enhance production
	of cashewnuts
Social, environmental, policy and	The technology is socially acceptable and environmentally
market conditions necessary for	friendly because it involves
development and up-scaling	i) Rejuvenating aged trees
	ii) Replacement of unproductive trees with improved
	(grafted) ones thus the tree population remains the
	same
	iii) The improved returns from the top worked trees,
	are much higher than those from aged trees
	iv) There is greater demand of the improved and grafted
D: Economic gender vulnerable an	casnew varienes d marginalized groups (VMCs) considerations
Basic costs	Total cost of graffing one seedling is KES 56.00
	Fortimeted gross mannin (at form gate or weight of confirm
Estimated returns	Estimated gross margin (at farm-gate or point of grafting

	selling) is KES 44.00
Gender issues and concerns in development, dissemination adoption and scaling up	 Limited ownership and control of land among women can limit their participation Labour intensity in cutting old huge trees can be prohibitive for women Limited access to capital among women can limit their participation Bias in training opportunities in favour of men on coppicing and top-working
Gender related opportunities VMG issues and concerns in	 Ease of participation of women since the technology does not require extensive land area. Reduced tree sizes makes the cashew production system more amenable to intercropping thereby boosting food and nutritional security and incomes among VMGs. Limited access to technical training opportunities
development, dissemination, adoption and scaling up	among VMGs
VMG related opportunities E: Case studies/profiles of success st	 Tree size is reduced through the technology making management operations such as spraying, pruning and harvesting easy for women, youth and vulnerable persons. Offers employment opportunities for VMGs as service providers Affirmative action opportunities such as the women and youth enterprise fund exists for VMGs to access the required credit to procure implements for coppicing e.g. power saws, pruning saws.
Success stories	 Increased use of KALRO top working technology in Kwale and Kilifi counties Technology adoption among private players and NGOs is increasing
Application guidelines for users F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	 Cashew planting guide, KALRO Mtwapa Cashew for Cash booklet, KALRO Mtwapa KALRO Cashew Nut <u>https://play.google.com/store/apps/details?id=com.andromo.dev724321.app928007</u> Cashew Nut Production, A reference handbook for farmers in Kenya, F.K. Muniu Website: <u>www.kalro.org</u> Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima Nchini Kenya, F.K. Muniu Pamphlet on cashew Top working –KALRO Mobile app on cashew propagation -KALRO 1. Ready for up scaling

G: Contacts	
Contacts	Institute Director, KALRO –ICRI Mtwapa
	kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO, Mtwapa: F. Muniu, M. Menza, S. Mwashumbe, F.
	Pole kalro.mtwapa@kalro.org
Partner organizations and contacts	Pwani University, <u>info@pu.ac.ke.S</u> - Muti H. Saha;
	Coast Development Authority J. Kombe

1. Requires validation in new areas

2. Requires further research

2.5 Soil Fertility Management

2.5.1 Integrated Manure Management (IMM)

TIMP name	Integrated Manure Management (IMM)	
Category (technology, innovation or management practice)	Management practice	
A: Description of the technology,	innovation or management practice	
Problem to be addressed	Land degradation characterized by the declining soil fertility, low yields, increased soil moisture stress, increased soil erosion and poor soil health. Poor manure management and handling leading to increased Green House Gases (GHG) emissions	
What is it? (TIMP description)	Integrated Manure Management (IMM) is the optimal, site- specific handling of livestock manure from collection, through treatment and storage up to application to crops (cashew).	
Justification	Adding manure to soils enhances soil fertility and soil health that leads to increased agricultural productivity, improved soil structure and biodiversity. Given the challenge of limited access to inorganic/synthetic fertilizers by resource-poor smallholder farmers, manure has the potential to provide the limiting nutrients and improve soil health.	
B: Assessment of dissemination and scaling up/out approaches		
Users of TIMP	Farmers	
Approaches used in dissemination	Open and field days, exchange visits and demonstration farms	
Critical/essential factors for successful promotion	 Training on preparation, management and use of manure Dissemination approach used to reach target farmers Model demonstration plots using cashew 	
Partners/stakeholders for scaling up and their roles	 KALRO - training County governments - provide extension services, farmer mobilization and policy formulation ILRI - technical backstopping NGOs - micro financing services AFA - value addition and processing Processors - value addition Cooperatives - marketing Transporters - transport services 	
C: Current situation and future s	scaling up	

promoted if any		
County where TIMP will be	Lamu Kilifi and Kwala	
promoted		
Challenges in dissemination	• Lack of model demonstration farms	
chancinges in dissemination	 Cultural challenges cashay training in ASAI 	
	• Cultural channenges – cashew training in ASAL	
	the main decision makers on actual production of the	
	crop.	
	 Lack of continuity in training of extension and farmers 	
	in the skill for manure management	
	• Lack of proper mobilization mechanism for reaching	
	many farmers	
Suggestions for addressing the	• Establishment of many demonstration plots by counties	
challenges	Capacity building of ASAL communities on manure	
2	management and its benefit	
	• Continuous capacity building of farmers and extension	
	workers	
	• Use of approaches to mobilize farmer to attend	
	demonstration forums	
Lessons learned if any	• Proper use of manures improves soil fertility	
	• Use of manures enhances crop productivity	
	• Skills in manure preparation, storage and	
	application contribute to soil health and high yields.	
Social, environmental, policy and	• Applying manure to soils saves on purchase of inorganic	
market conditions necessary	fertilizer, increases crop yield and saves water.	
	 Propagation of invasive species when the seed is ingested by the animal and passed to crop field 	
	• Manure can harbor pathogens which can cause disease	
	outbreaks to cashew	
	• Contamination of water sources by leaching of nutrients	
	• Organic manures when poorly handled increase GHG	
	emissions. However, IMM provides practices that are able	
	to minimize GHG emissions.	
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations		
Basic costs	• Purchase of lacre equivalent manure-load (including	
	transport costs) @ KES. 8,000/=	
Estimated ratures	 Labor for application @ KES. 0,000/= per acre Passed on the level of adoption, this TIMD con 	
Esumated returns	• Dased on the level of adoption, this Thype can increase the total returns from the group by	
	approximately 50%	
Gender issues and concerns in	Women have limited access to farm inputs such as	
development, dissemination	manures than men	
adoption and scaling up	Women have less access to information technology	
acoption and bound up	and knowledge	
	• Women have less access to land that can be used for	
	water pan than men	
	• Women have limited access to education, training and	
Lessons learned if any Social, environmental, policy and market conditions necessary D: Economic, gender, vulnerable Basic costs Estimated returns Gender issues and concerns in development, dissemination, adoption and scaling up	 management and its benefit Continuous capacity building of farmers and extension workers Use of approaches to mobilize farmer to attend demonstration forums Proper use of manures improves soil fertility Use of manures enhances crop productivity Skills in manure preparation, storage and application contribute to soil health and high yields. Applying manure to soils saves on purchase of inorganic fertilizer, increases crop yield and saves water. Propagation of invasive species when the seed is ingested by the animal and passed to crop field Manure can harbor pathogens which can cause disease outbreaks to cashew Contamination of water sources by leaching of nutrients Organic manures when poorly handled increase GHG emissions. However, IMM provides practices that are able to minimize GHG emissions. and marginalized groups (VMGs) considerations Purchase of lacre equivalent manure-load (including transport costs) @ KES. 6,000/= per acre Based on the level of adoption, this TIMP can increase the total returns from the crop by approximately 50%. Women have limited access to farm inputs such as manures than men Women have less access to land that can be used for water pan than men Women have limited access to education, training an 	

	extension services than men.	
	• Men dominate in decision-making at the household and	
	community levels	
Gender related opportunities	Women can have opportunities in manure application and earn	
Gender related opportunities	an extra income	
VMG issues and concerns	Less access to farm inputs such as manures than man	
in development	• Less access to rarm inputs such as manures than men	
dissemination adoption	• Less access to agricultural information, technology and	
and appling up	Knowledge	
and scamp up	• Entitled access to productive resources such as fand, credit, and quality seed	
	• Limited access to training and extension services	
	• Due to their social status VMGs are often excluded from	
	decision making in development and dissemination	
	activities	
	 Low adoption by VMGs due lack of awareness 	
VMG related opportunities	Unemployed youths can have opportunities in manure	
vivio related opportunities	application and earn an extra income	
E: Case studies/profiles of success stories		
Success stories	Farmers who adopt manure management practice have reported	
	improved soil health and increased crop yield, and sustainable	
	source of income	
Application guidelines for users	• ISFM –Integrated Soil Fertility Management in Africa:	
	Principles, Practices and Developmental Process book.	
	TSBF/CIAT	
	• Leaflets	
F: Status of TIMP readiness (1.	1. Ready for up scaling	
Ready for up scaling; 2. Requires		
validation; 3. Requires further		
research)		
G: Contacts		
Contacts	1. Director, Environment & Natural Resources KALRO	
	Secretariat;	
	2. Institute Director, KALRO –ICRI Mtwapa	
	Kalro.Mtwapa@kalro.org	
Lead organization and scientists	KALRO: S. Kimani, E. Mutuma, D. Kamau, M. Okoti, J.	
	Wamuongo, A.O. Esilaba	
Partner organizations and contacts	County government, Private Public Partnerships	

- 1. Promote IMM complementary technology in counties that have not practiced it.
- 2. Conduct nutrient budget study on selected farms utilizing manures (including composts) in each of the cashew growing counties.
- 3. Requires validation in new areas
- 4. Requires further research

2.5.2 Integrated Soil Fertility Management (ISFM)

TIMP name	Integrated Soil Fertility Management (ISFM)	
Category (technology,	Management practice	
innovation or management		
A: Description of the techn	ology, innovation or management practice	
Problem to be addressed	Declining soil fertility low organic matter degraded soil structure and	
	poor soil moisture conservation for cashew production.	
What is it? (TIMP	A set of soil fertility management practices that include the use of	
description)	fertilizers and locally available organic inputs to improve and maintain	
	soil's potential for high crop yields. It places emphasis on the importance	
	of using often scarce resources like fertilizer and organic inputs	
	of fertilizer directly in area of root zone to increase the potential for	
	untake) and micro dosing (applying small quantities of fertilizer with	
	the seed at planting time and a few weeks after emergence).	
Justification	Integrated Soil Fertility Management (ISFM) has the ability to optimize	
	agronomic use efficiency of the applied nutrients for improved crop	
	productivity.	
B: Assessment of dissemination and scaling up/out approaches		
Users of TIMP	Farmers	
Approaches to be used in	• Farmer Field and Business School (FFBS)	
dissemination	Agricultural innovation platforms (AIP)	
	Demonstrations - On-farm and on station	
	 Agricultural shows/exhibitions/field days 	
	• Trainings - workshops/Seminars/Meetings	
	Public and private Extension Agents	
	• Farmer-to-farmer extension models	
	Mass media - Electronic and print	
	Publications - posters/brochures/leaflets, manuals	
	• Digital Platforms - Website, Dashboards, Apps, social media short	
	message services	
Critical/essential factors	• Availability of affordable and quality manure and fertilizers	
for successful promotion	• Take into account the variability between farms, in terms of farming	
	livestock importance of off-farm income: and	
	 Take into account the amount of production resources (land, capital. 	
	labour, crop residues) in which different farming families are able	
	to invest.	
Partners/stakeholders for	• County government extension services; linking farmers to various	
scaling up and their roles	stakeholders.	
	• Community farmer groups; playing coordination role for ease in problem identification and dissemination	
C: Current situation and fu	iture scaling up	
Counties where already	Machakos, Busia, Siaya, Kisumu, Kakamega, Tharaka Nithi, Isiolo,	
promoted if any	Nyeri, Uasin Gishu, Elgeyo Marakwet	
County where TIMP will	Lamu, Kilifi and Kwale	
be promoted		

Challenges in dissemination	• Fixed mindset in some regions/cultures that organic manures
	cannot be applied on crops
	• Misconceptions that the use of chemical fertilizers lead to loss of inherent soil fertility and soil degradation.
Suggestions for addressing	Awareness trainings on the role of organic manure in cashew
the challenges	production.
	• Training and awareness creation on the usefulness of fertilizer applications to clear the misconceptions about fertilizers
Lessons learned, if any	For ISFM to succeed, healthy and viable germplasm/seed/seedlings,
	among others are required since farmers tend to re-use previous planted
	materials.
Social, environmental,	• The practice is socially acceptable and environmentally friendly
policy and market	• More healthier soils with increased soil microbiota thereby enhancing
conditions necessary	nutrient availability and yields
	• Increased productivity will provide supply to the markets
	• Policy frameworks are available to support the promotion of this
D: Economic gender vuln	practice. erable and marginalized groups (VMCs) considerations
D. Economic, genuer, vuin	Depende on chains of the technology options interacted into this provide
Basic costs	as influenced by the basic input costs
Estimated returns	Farmers who have adopted ISFM have more than doubled their yields
	and increased their farm- level incomes by over 50 percent
Gender issues and concerns	The practice integrates participation of male and female gender roles
in development,	during field activities. Female gender are disadvantaged where
dissemination adoption and	application of heavy loads of manure are to be incorporated in the field.
scaling up	Adoption and scaling up of ISFM technologies could be affected by the
	ownership of the farm that are mainly male owned whereas the man does
	not own the technology
Gender related opportunities	Apart from the inorganic fertilizers and good seed, the practice adopts
	other locally available materials that saves on cost which is good for all
	gender in the farm household.
VMG issues and concerns	• VMGs are physically disadvantaged for a practice that seeks to
in development,	incorporate manures in the farm.
dissemination adoption	• They are also resource poor and may not have the resources to
and scaling up	purchase seed and fertilizers as required for successful
	implementation of the practice.
VMG related	• The technology if well-practiced can increase farm incomes of
opportunities	VMGs by up to 50%.
	• Affirmative action opportunity exists for VMGs in various areas as
	for instance in the provision of finances
	Increased production leading to increased consumption and
	utilization of cashew and hence improved health of VMGs
E: Case studies/profiles of	success stories
Success stories	ISFM successes have been reported in other crops such as maize in
A pullication or italized f	Mitwapa where productivity has been improved.
Application guidelines for	1. ISFIN – Integrated soll fertility management in Africa:
45015	TSBF/CIAT

	2. Leaflets
F: Status of TIMP	1. Ready for up scaling
readiness	2.
(1. Ready for up scaling; 2.	
Requires validation; 3.	
Requires further research)	
G: Contacts	
Contacts	Institute Director, KALRO – ICRI Mtwapa Kalro.Mtwapa@kalro.org
Lead organization and	KALRO: C. Ondiko, B. Muli, A. Mzingirwa, E. Gikonyo, D.
scientists	Kamau, A. O. Esilaba, J. Ndufa
Partner organizations and	County governments, KEFRI &
contacts	NGOs

- 1. Validation of the ISFM technology in counties where technology has not been tested
- 3. Testing (fertilizer types, rates, frequencies) with different value chains
- 4. Requires validation
- 5. Requires further research

2.5.3 Rapid soil testing services

TIMP name	Rapid soil testing services
Category (technology,	Management practice
Innovation or management	
practice)	
A: Description of the technolog	y, innovation or management practice
Problem to be addressed	 Conventional methods for soil testing are not affordable to farmers and take long to release results that are not reproducible. The methods have not provided solutions for paired soil and leaf testing to determine health of soil and crop simultaneously. Limited access to standardized soil testing services (centralized acid testing laboratoriae and east)
	soil testing laboratories and cost).
what is it? (Thyp description)	interaction of electromagnetic radiation with matter to characterize biochemical composition of a soil and/or plant tissue.
Justification	Soil testing is the basis for good fertilizer management that maintains the productivity of soil and improves the quality of crops. It promotes more efficient fertilizer use and prevents environmental pollution from excess fertilizer application, and cost efficiency. However, limited access to soil testing services is depriving the farmers' ability to make informed decisions with regard to soil management and fertilizer use.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Extension officers
Approaches to be used in	• Farmer Field and Business School (FFBS)
dissemination	Agricultural innovation platforms (AIP)

	Demonstrations - On-farm and on station
	• Agricultural shows/exhibitions/field days
	• Trainings - workshops/Seminars/Meetings
	Public and private Extension Agents
	 Farmer-to-farmer extension models
	 Mass media Electronic and print
	• Mass media - Electronic and print
	• Publications - posters/brochures/leaflets, manuals
	 Digital Platforms - Website, Dashboards, Apps, social media short message services
Critical/essential factors for	• Availability of the necessary equipment for rapid the spot soil
successful promotion.	testing
	• Established rapport between farmers and the technical personnel
	involved in soil testing
	• Adequate qualified staff to cover the large number of samples from
	the target 24 counties before the planting season begins.
	• A well-designed storage system for keeping information obtained
	at farm level including (GPS readings, physical description of the
	locations raw measured scanned data and fertilizer
	recommendations for cashew)
	• Formers must understand trust and be willing to act upon the
	• Farmers must understand, trust, and be writing to act upon the
Partners/stakeholders for	• County government extension services; providing the link to
scaling up and then toles	• Soil Cares: Provides soil scappers technology and capacity
	building in collaboration with KALRO and ICRAF
	• ICRAF and iSDA tests and validates the recommendation
	obtained in collaboration with Soil Cares and KALRO.
	• Fertilizer companies; To provide fertilizer blends according to soil
	health status
	• Agro dealers to stock required fertilizers that is readily available
	to farmers
C: Current situation and futur	e scaling up
Counties where already	Technology has not been promoted though testing has been
Counting where TIMP will be	Ongoing in a few counties
up scaled	Lanu, Kinn and Kwale
Challenges in dissemination	• Soil mapping services utilising gamma-ray spectroscopy (GRS)
C	are not sufficiently accurate to predict soil nutrient needs and
	therefore inappropriate for nutrient management planning
	• It requires continuous updating methods to improve
	recommendations.
	• Lack of awareness on the importance of regular testing of soil
	quality
Suggestions for addressing the	• There is need for further research to explore the limitations of,
challenges	and opportunities for, the universal application of these
	technology across different soll types and/or land uses before

	their commercial application	
	• Awareness creation, intensive farmer field training (capacity	
	building)	
	• Make the whole process cost-effective	
	• Use of scanners (spectroscopy) and less wet chemistry analysis.	
	• Automated pipelines for updating existing recommendation	
	methods.	
Lessons learned in upscaling, if	• Timely affordable soil information will guide on fertilizer use	
any	• Wrong choice and inappropriate application of fertilizers have	
	frustrated farmers' efforts towards increasing cashew yields	
Social environmental policy	• Socially acceptable - generates income increases food	
and market conditions	production supplements nutritional security and promotes family	
necessary	cohesion	
necessary	• Environmentally friendly - farmers only apply the required	
	amounts of fertilizers hence no excess nutrients to contaminate	
	around and surface water	
	 Supportive policy frameworks are available 	
	 Supportive portey frameworks are available. Increased productivity will provide supply to the markets 	
D. Economic gender vulnerat	• Increased productivity will provide supply to the markets	
D. Economic, genuer, vumerable and marginanzeu groups (viviGs) considerations		
Basic costs	• The cost of analyzing one soil sample still remains @ KES.	
	1,000/=.	
	• Iransaction costs for collecting soil samples (by experts	
	including their transport costs) and dispatch may average to KES.	
	1,250/=. However since more than one sample must be collected	
	(a minimum of six samples per farm), the	
	average cost of a sample can be estimated at KES. $7,500/=$ for an	
	average farm of 3-5 acres.	
	Note: the number of soil samples is largely influenced by the degree of soil type variability of the form	
Estimated returns	Dependent on the enterprise adopting the service, but estimated at	
Estimated feturits	Dependent on the enterprise adopting the service, but estimated at	
	great again	
Conder issues and concerns in	By bringing convices closer to the users serves time and resources	
development discomination	by bringing services closer to the users saves time and resources	
adoption and appling up	to the farmers (men, women and youth).	
Conder related emperturities	Waman have loss appage to analit to new for the convices then	
Gender related opportunities	• Women have less access to credit to pay for the services than	
	Women have less access to information technology	
	• Women have less access to information, technology	
	and knowledge	
	• women have less access to land that can be used for water pan	
	unan men Women have limited eccess to education training and extension	
	• women have limited access to education, training and extension services than men	
	• Men dominate most decisions at the household and community	
	levels	
VMG issues and concerns in	Offers employment especially for the youth who could be trained	
development dissemination	as soil sampling champions and later offer the services to help	
adoption and scaling up	the local communities	
VMG related opportunities	• Loss access to form inputs such as analit to now for the corriges	
v with related opportunities	• Less access to farm inputs such as credit to pay for the services	

	 than men Less access to agricultural information, technology and knowledge Limited access to productive resources such as land, credit, and quality seed Limited access to training and extension services Due to their social status VMGs are often excluded from decision making in decalement and discontingation extincities
	 Low adoption by VMGs due lack of awareness
E: Case studies/profiles of succ	ess stories
Success stories	 Has been tested and used successfully by other organizations like ICRAF, Soil Cares & KESREF. It has been adopted at Kenya cane testing Centre for checking maturity level and quality of sugarcane.
Application guidelines for users	 Methods for rapid testing of plants and soil nutrients. In Book Manual Sustainable Agriculture Reviews 25 (pp 1-43) 2017. Springer International Publishing. J.R. Okalebo, K.W. Gathua ad P.L Woomer. Laboratory methods of soil and plant analysis: Working manual. Second edition. SACRED Africa 2002.
F: Status of TIMP readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	1. Ready for up scaling
G: Contacts	
Contacts	 Director, Environment & Natural Resources, KALRO secretariat Institute Director, KALRO – ICRI Mtwapa, Kalro.Mtwapa@kalro.org
Lead organization and scientists	KALRO: C. Kibunja, A. Sila, D. Kamau, A.O. Esilaba
Partner organizations and contacts	County governments in the 24 counties, Soil Cares, ICRAF and iSDA

- 1. Testing paired soil and crop samples to determine nutrients in the soil and what is available to plant.
- 2. Determine nutrient deficiency and make recommendation for the type of fertilizer to use and at what rate.
- 3. Developing a fertilizer recommendation system with options for new blends.
- 4. Working with fertilizer companies to produce fertilizer blends packaged in smaller quantities per farmer needs.
- 5. Using scanners at farm level to undertake fertilizer quality analysis, including quantitative and qualitative analysis, major and trace elemental analysis, and chemical and physical analysis.
- 6. Updating existing soil maps with newly acquired soil data to provide current soil fertility status in the country.

2.6 Soil and Water Management

261	Contour	hunds
4.0.1	Contour	Dunus

TIMP name	Contour bunds		
Category (technology,	Management practice		
innovation or			
management practice)	, impossion on monogoment prosting		
A: Description of the technolog	Description of the technology, innovation or management practice		
Problem to be addressed	The risk of soil erosion and increased run off; low soil water		
What is it? (TIMP description)	Contour bunds are stone or earthen walls built across a slope to prevent runoff. Making furrows parallel to the contours ensures that rainfall and runoff are spread evenly over a field. The earthen bund is formed by excavating a channel and creating a small ridge on the downhill side. Thus contour bunds resemble narrow channel terraces commonly referred to as "fanya chini" terraces. The technology is highly suitable for areas with unpredictable rains especially the drought-prone areas (ASALs).		
Justification	Contour bunds and hedgerows help to concentrate moisture into the ridge and furrow area where the crops are planted by trapping run off water from the catchment area between them. This decreases the risk of erosion. Plants with higher water requirements, such as peas or beans, can be planted on the higher side of the furrow whereas cereal crops requiring less water, such as cashew or millet, can be planted on the ridges.		
B: Assessment of dissemination	and scaling up/out approaches		
Users of TIMP	Farmers		
Approaches to be used in	Farmer Field and Business School (FFBS)		
dissemination	Agricultural innovation platforms (AIP)		
	• Demonstrations - On-farm and on station		
	Agricultural shows/exhibitions/field days		
	• Trainings - workshops/Seminars/Meetings		
	Public and private Extension Agents		
	• Farmer-to-farmer extension models		
	• Mass media - Electronic and print		
	• Publications - posters/brochures/leaflets, manuals		
	• Digital Platforms - Website, Dashboards, Apps, social media short message services		
Most effective approach	Model farm demonstration		
Critical/essential factors for	• Availability of labour as the application of this practice is		
successful promotion	labour intensive.		
	• Farmers and extension service with skills to design and construct, contour bunds		
	 Land tenure systems that allows individual ownership 		
Partners/stakeholders for	County government extension service providers – delivery		
scaling up and their roles	of information to farmers, technology access, capacity building		

	• Community farmer groups – establishment of on-farm	
	demonstration plots to hold farmer field schools.	
	KALRO – Capacity building	
C: Current situation and future	e scaling up	
Counties where already promoted if any	Makueni, Machakos, Tharaka Nithi, Kakamega, Nyeri, Meru	
County where TIMP will be promoted	Lamu, Kilifi and Kwale	
Challenge(s) in development and dissemination	 Increased risk of soil erosion if contours are improperly laid out Labour intensive and many farmers may find it difficult 	
	 to implement on large scale Land tenure systems - communal land ownership, or lack of individual land ownership rights. 	
Suggestions for addressing the challenges	• Farmers need to be supported with appropriate equipment for preparation of contour bunds for efficiency and increased output per man hour.	
	• Training youthful farmers to be champions of contour bunds construction at the ward/village level.	
	 Training on site specific designs and construction of contour bunds East track land registration 	
Lessons learned, if any	 Contour bunds are largely popular due to the rapid benefits they give in terms of improved crop performance. 	
	• Existence of well-developed self-help groups can lead to successful soil and water conservation activities.	
	• Conducting well publicized campaigns has been found to add to the success of soil and water conservation.	
	• Similarly, when the farmers are adequately trained and sensitized on the technology, many of them would be willing to invest.	
Social, environmental, policy and market conditions necessary	 Enforce policies on soil and water conservation at the county level 	
	• Create awareness on the importance of soil and water conservation	
	 Avail low-cost options for soil and water conservation Policies that support individual land tenure systems 	
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations		
Basic costs	The main input cost is the labour for <i>contour</i> preparation. The cost will depend on the land size and the landscape terrain/slope. However, the current market rates/cost of KES. 450/= per day holds	
Estimated returns	The returns depends on the value chain being addressed	
Gender issues and concerns in development, dissemination, adoption and scaling up	 Ownership of or access to land may limit women in some regions Making decisions on land use may limit women in some regions where decision making is men dominated Differing accessibility of the technology and information may disadvantage different gender 	
	• The technology is labour intensive hence may disadvantage women and members who cannot procure labour services	

	• Differing accessibility of information between men and women	
	because of gender norms that place access to new information	
	and technologies in the hands of male heads will affect adoption	
	and scaling up.	
	• Ownership of or access to land and credit will affect adoption	
	and scaling up.	
Gender related opportunities	Potential for employment creation for youth who can	
	provide labour during the implementation of the	
	technology.	
VMG issues and concerns in	• Limited of access to information may limit the VMG	
development, dissemination,	from technology access and use	
adoption and scaling up	• Limited attendance during awareness and sensitization	
	campaigns due to physical body challenges or	
	insecurity challenges limits use of technologies.	
	• The technology is labour intensive and may be difficult for	
	the VMG to implement in the field.	
	• The labour cost of adopting this technology might be out of	
	reach for the VMGs thus affecting adoption and scaling up	
	 The technology demands proper training and access to 	
	information to enable proper implementation. This might	
	he lacking among the VMGs	
	 Competing priorities and household decisions might 	
	 Competing priorities and nousehold decisions might hinder adoption and scaling up 	
VMC related	 Dotantial for amployment creation for unamployed youths who 	
opportunities	can provide labour during the implementation of the	
opportunities	technology	
E: Case studies/profiles of succ	ess stories	
European staring if any	Mukatha Mhithi is a mambar of the Vyungu Myusthya group in	
Success stories, if any	Machakas	
	Wachakos	
	before making the terraces we than t have good harvests because	
	into the river and the maine group short. But when we made termose	
	the soil experies stopped and we get good erong?	
Agalization anidalinas for	the solid for selecting the right soil and water concernation practices.	
Application guidennes for	A guide for selecting the right soft and water conservation practices	
users	for small-holder farming in Africa. Technical manual No. 24.	
	world Agrotorestry Center (ICRAF).	
F: Status of TIMP readiness (1.	1. Ready for up scaling	
Ready for up scaling; 2. Requires		
validation; 3. Requires further		
research)		
G: Contacts		
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Lead organization and	KALKO: E. Mutuma; J. Wamuongo; M. Wairimu; P. Kitiem, J.	
Scientists	Mwaura; D. Kamau and A.O. Esilaba.	
Partner organizations and	County Governments extension offices.	
contacts		

- 1. Develop site specific designs for construction validation in other regions
- 2. Conduct trade off analysis (economic analysis) of contour bunds as a soil and water management technology in the various AEZs and along specific value chains
- 2. Develop low-cost mechanized tools to ease labour demands in contour construction and maintenance
- 3. Requires validation in new areas

2.6.2 Zai Pits		
TIMP name	Zai Pits	
Category (technology, innovation or management practice)	Management practice	
A: Description of the technolog	gy, innovation or management practice	
Problem to be addressed	Unreliable water to sustain a crop as a result of high seasonal rainfall variability leading to total crop failures. Decreased yields leading to food insecurity.	
What is it? (TIMP description)	Zai Pits are planting pits typically measuring 15 - 30 cm in width, 10 - 20 cm deep and spaced 60 - 80 cm. Zai Pits harvests and stores water for prolonged crop use. Farmers plant into the pits after filling one to three handfuls of organic material such as manure, compost, or dry plant biomass. The technology is highly suitable for areas with unpredictable rains especially the drought-prone areas (ASALs). For cashew, the pits will be modified.	
Justification	<i>Zai</i> Pits have the potential to harvest and store rain water for prolonged crop use. They also contribute to improving the management of degraded lands, reducing soil erosion, vegetation loss and biodiversity as well as crop yield	
B: Assessment of dissemination	n and scaling up/out approaches	
Users of TIMP	Farmers	
Approaches to be used in dissemination Most effective approach	 Farmer Field and Business School (FFBS) Agricultural innovation platforms (AIP) Demonstrations - On-farm and on station Agricultural shows/exhibitions/field days Trainings - workshops/Seminars/Meetings Public and private Extension Agents Farmer-to-farmer extension models Mass media - Electronic and print Publications - posters/brochures/leaflets, manuals Digital Platforms - Website, Dashboards, Apps, social media short message services Model farm demonstration 	
Critical/essential factors for successful promotion	 Availability of labour as the technology is labour intensive. Farmers and extension service with skills to design and 	

7.

	construct
	• Zai pits.
Partners/stakeholders for	 County government extension services – delivery of information inputs to farmers
seaming up and men roles	 Community farmer groups – establishment of on-farm
	demonstration plots to hold farmer field schools
	• NGOs – capacity building, policy support in soil and
	water conservation issues
C: Current situation and future	e scaling up
Counties where already promoted if any	Makueni, Machakos, Tharaka Nithi, Kakamega, Nyeri, Meru
County where TIMP will be promoted	Lamu, Kilifi and Kwale
Challenge (s) in development and	The management practice is labour intensive and many farmers
dissemination	may find it difficult to implement at large scale.
Suggestions for addressing the	• Farmers need to be supported with appropriate equipment
chanenges	output per man hour
	 Training vouthful farmers to be champions of
	Zai pits construction at the ward level/village
	level.
Lessons learned, if any	• The management practice has a huge potential to
	increase farmers' resilience especially in ASALs.
	sensitized on the technology many of them would be
	willing to invest.
Social, environmental, policy and	• Enforce policies on soil and water conservation at the
market conditions necessary	county level
	• Create awareness on the importance of soil and
	water conservation
	• Avail low-cost technologies for soil and water conservation
	 Policies that support individual land tenure systems Provide support in the establishment of the Zai pits
D: Economic, gender, vulnerabl	e and marginalized groups (VMGs) considerations
Basic costs	The main input cost is the labour for <i>Zai</i> Pit preparation. It is
	estimated at KES 40 to 100 per Zai Pit
Estimated returns	Yet to be determined
Gender issues and concerns in	• The technology is labour intensive and therefore may
development, dissemination,	increase women labour burden
adoption and scaling up	• Women have less access to agricultural information,
	technology and knowledge
	• women and youth have limited access to productive resources such as land, quality seed and credit
	 Women and youth have limited access to education
	training and extension services than men
	 Men dominate most decisions at the household and
	community levels
Gender related opportunities	• Potential to create employment for youth through

	provision of the labour required
VMG issues and concerns in	• Less access to agricultural information, technology and
development, dissemination,	knowledge
adoption and scaling up	• Limited access to productive resources such as land,
	credit, and quality seed
	• Limited access to training and extension services
	• Due to their social status VMGs are often excluded from
	decision-making in development and dissemination
	activities
	• Low adoption by VMGs due lack of awareness
VMG issues and concerns in	Opportunities exist for youth in provision of labour
adoption and scaling up	
VMG related opportunities	• The technology is labour intensive therefore may
	increase women labour burden
	Women have less access to agricultural
	information, technology and knowledge
	Women and youth have limited access to productive
	resources such as land, quality seed and credit
	• Women and youth have limited access to education, training
	and extension services than men
	• Men dominant most decisions at the household and
	community levels
E: Case studies/profiles of succ	ess stories
Success stories, if any	Two women groups in Kikiki, Matungulu sub-County of
	Machakos County through a representative Janet Ndunge
	reported having started using the Zai pit farming technology in
	2013 after attending a farming workshop by the Institute for
	Culture and Ecology (ICE). "Ever since we started using Zai
	pits, we have seen an increase in our harvests as compared to the
	conventional methods of farming," she said.
	Farmers in Kathonzweni Makueni County increased dug nits
	from 170 to 500 pits for crop production due to initial observed
	benefits.
	Communities in ASALs have also rehabilitated degraded lands and
	increased production by many folds.
Application guidelines for	A guide for selecting the right soil and water conservation practices
users	for small-holder farming in Africa. Technical manual No. 24.
	World Agroforestry Center (ICRAF).
F: Status of TIMP readiness	1. Ready for up scaling
1. Ready for up scaling,	
2=Requires validation;	
3=Requires	
Turtner research	
Contacts	Contro Director, KALDO Vahata E maile
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Lead organization and scientists	KALRO: E. Mutuma; J. Wamuongo; M, Wairimu; P. Ketiem, J.
	Mwaura; D. Kamau and A.O. Esilaba.
Partner organizations and	County Governments extension offices.
contacts	

1. Validation of the economic viability of the technology in counties where it has never been used.

2.6.3	Bench	terraces

TIMP name	Bench terraces
Category (technology, innovation or management practice)	Management practice
A: Description of the technolog	y, innovation or management practice
Problem to be addressed	The risk of soil erosion and increased run off; low soil water retention capacity in most soils
What is it? (TIMP description)	Bench terraces consist of a series of beds which are more or less level running across a slope at vertical intervals, supported by steep banks or risers (walls or bunds). The flat beds created by bench terraces enable the cultivation of crops on medium to steep slopes. The technology is highly suitable for semi-arid to humid regions of rainfall, 700mm or more; medium to steep slopes (12- 47%) (Bench terraces are not recommended for slopes less than 12%); soil depth of greater than 50cm; and areas with no gullies, nor stones.
Justification	Conservation of soil and moisture through construction of terraces has led to better and more reliable crop yields especially in the ASAL counties of Kenya.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches to be used in dissemination	 Farmer Field and Business School (FFBS) Agricultural innovation platforms (AIP) Demonstrations - On-farm and on station Agricultural shows/exhibitions/field days Trainings - workshops/Seminars/Meetings Public and private Extension Agents Farmer-to-farmer extension models Mass media - Electronic and print Publications - posters/brochures/leaflets, manuals

	 Digital Platforms - Website, Dashboards, Apps, social media short message services
Critical/essential factors for	 Availability of labour as the technology is labour intensive
successful promotion	 Farmers and extension service providers with skills to
	design and construct contour bunds.
	• Land tenure systems that allows individual ownership
Partners/stakeholders for	• County government extension service providers –
scaling up and their roles	delivery of information to farmers, technology access,
	capacity building
	• Community farmer groups – establishment of on-farm
	demonstration plots to hold farmer field schools.
	• External service providers – capacity building and
	access to technology
C: Current situation and future	scaling up
Counties where already promoted if any	Makueni, Machakos, Tharaka Nithi, Kakamega, Nyeri, Meru
County where TIMP will be	Lamu, Kilifi and Kwale
promoted Challenge (a) in development and	Increased right of apil energies if terrases are increased with loid out
dissemination	 Increased fisk of soli erosion in terraces are improperty faid out Labour intensive during construction and maintenance and
dissemination	• Labour intensive during construction and maintenance and many farmers may find it difficult to implement at large scale
	 I and tenure systems – communal land ownership, or lack
	of individual land ownership rights.
Suggestions for addressing the	 Farmers need to be supported with appropriate equipment
challenges	for preparation of bench terrace for efficiency and increased
	output per man hour.
	• Training youthful farmers to be champions of making
	bench terraces construction at the ward level/village
	level.
	• Training on site specific designs and construction of
	bench terraces
	Fast track land registration
Lessons learned, if any	• Terracing is largely popular due to the rapid benefits it gives
	In terms of improved crop performance.
	• Existence of weil-developed self-neip groups can lead
	• Conducting well publicized compaigns has been found to
	• Conducting wen publicized campaigns has been found to promote the success of soil and water conservation
	• Similarly, when the farmers are adequately trained and
	sensitized on the technology many of them would be willing
	to invest.
Social, environmental, policy and	• Enforce policies on soil and water conservation at the
market conditions necessary	county level
	• Create awareness on the importance of soil and
	water conservation
	• Provide low-cost technologies for soil and water conservation
D. Foonomio gender mile di	• Policies that support individual land tenure systems
D: Economic, gender, vuinerabl	e and marginalized groups (VIVIGS) considerations
Basic costs	The main input cost is the labour for <i>bench</i> preparation. The cost

	will depend on the land size and the landscape terrain/slope. However, the current market rates/cost of KES. 450/= per day holds
Estimated returns	Yet to be determined
Gender issues and concerns in development, dissemination, adoption and scaling up	 Bench terrace establishment is labour intensive therefore may increase women work burden Women have less access to agricultural information, technology and knowledge Women and youth have limited access to productive resources such as land, quality seed and credit Women and youth have limited access to education, training and extension services. Men dominant most decisions at the household and community levels
Gender related opportunities	Potential to create employment for youth through provision of the labour required
VMG issues and concerns in development and dissemination	 Less access to agricultural information, technology and knowledge Limited access to productive resources such as land, credit, and quality seed Limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities Low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities exist for youth exists in provision of labour
E: Case studies/profiles of succ	ess stories
Success stories, if any	Mukethe Mbithi is a member of the Kyungu Mwethya group in Machakos "Before making the bench terraces we didn't have good harvests because the soil was eroded. When we put fertilizer on, the water washed it into the river and the maize grew short. But when we made terraces the soil erosion stopped and we got good crops.
Application guidelines for users	A guide for selecting the right soil and water conservation practices for small-holder farming in Africa. Technical manual No. 24. World Agroforestry Center (ICRAF).
F: Status of TIMP readiness (1. Ready for upscaling, 2 Requires validation; 3. Requires further research)	1. Ready for up scaling
G: Contacts	·
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Lead organization and scientists	KALRO: E. Mutuma; J. Wamuongo; M, Wairimu; P. Kitiem, J. Mwaura; D. Kamau.
Partner organizations and Contacts	County Governments extension offices.

Requires validation in new areas where it has not been practised

2.6.4 Fanya Juu Terraces

TIMP name	Fanya Juu Terraces
Category (technology, innovation or management practice)	Technology
A: Description of the technolog	y, innovation or management practice
Problem to be addressed	The risk of soil erosion and increased run off; low soil water retention capacity in most soils
What is it? (TIMP description)	'Fanya juu' terraces (juu is Swahili word for 'up') are constructed by excavating soil and throwing it up-slope to make an embankment. The embankment forms a runoff barrier and the trench (ditch) is used to retain or collect runoff. The embankments are usually stabilized with fodder grasses. Crops, such as bananas, Pawpaws, citrus and guava, are grown in the ditches. Through gradual redistribution of soils within the field, the terraces level off. The technology is highly suitable in low annual rainfall areas (less than 700 mm); moderate slopes (less than 20%); deep soils (more than 60 cm); and hilly areas that are subject to widespread erosion.
Justification	Cashew production is threatened by soil erosion and limited soil moisture. Conservation of soil and moisture through construction of terraces has led to better and more reliable crop yields especially in the ASAL counties of Kenya.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches to be used in	Farmer Field and Business School (FFBS)
dissemination	• Agricultural innovation platforms (AIP)
	• Demonstrations - On-farm and on station
	Agricultural shows/exhibitions/field days
	• Trainings - workshops/Seminars/Meetings
	Public and private Extension Agents
	• Farmer-to-farmer extension models
	Mass media - Electronic and print
	• Publications - posters/brochures/leaflets, manuals
	• Digital Platforms - Website, Dashboards, Apps, social media short message services

Critical/essential factors for	• Availability of labour as the technology is labour intensive
successful promotion	• Farmers and extension service with skills to design and
	construct contour bunds.
	Land tenure systems that allows individual ownership
Partners/stakeholders for	• County government extension service providers –
scaling up and their roles	delivery of information to farmers, technology access,
	capacity building
	• Community farmer groups – establishment of on-farm
	demonstration plots to hold farmer field schools
	• External service providers – capacity building and
	access to technology
C: Current situation and future	e scaling up
Counties where already promoted if any	Makueni, Machakos, Tharaka Nithi, Kakamega, Nyeri, Meru
County where TIMP will be promoted	Lamu, Kilifi and Kwale
Challenge(s) in development and	• Increased risk of soil erosion if terraces are improperly laid
dissemination	out
	• Labour intensive and many farmers may find it
	difficult to implement at large scale
	• Land tenure systems – communal land ownership, or
	lack of individual land ownership rights.
Suggestions for addressing the	• Farmers need to be supported with appropriate
challenges	equipment for preparation of terraces for efficiency and
	increased output per man hour.
	• Training youthful farmers to be champions of 'fanya juu'
	terraces construction at the Ward level/village level.
	• Training on site specific designs and construction of
	'fanya juu' terraces
L	• Fast-track land registration
Lessons learned, if any	• Fanya juu' terracing is popular due largely to the rapid
	benefits it gives in terms of soil and water conservation
	• Existence of well-developed self-help groups can
	lead to successful soil and water conservation
	activities
	 Conducting wen publicized campaigns has been found to add to the success of soil and water concernation
	and to the success of son and water conservation
	• Similarly, when the farmers are adequately trained and sensitized on the technology, many of them would be
	willing to invest
Social environmental policy and	 Enforce policies on soil and water conservation at the
market conditions necessary	county level
	• Create awareness on the importance of soil and
	water conservation
	• Avail low-cost technologies for soil and water conservation
	 Policies that support individual land tenure systems
D: Economic, gender, vulnerab	le and marginalized groups (VMGs) considerations
Basic costs	The main input cost is the labour for terrace preparation. The cost

	will depend on the land size and the landscape terrain/slope
Estimated returns	Yet to be determined
Gender issues and concerns in development, dissemination, adoption and scaling up	 The technology is labour intensive therefore may increase women labour burden Women have less access to agricultural information, technology and knowledge Women and youth have limited access to productive resources such as land, quality seed and credit Women and youth have limited access to education, training and extension services than men Men dominate most decisions at the household and community levels
Gender related opportunities	 Potential to create employment for youth through provision of the labour required
VMG issues and concerns in development and dissemination	 The technology is labour intense and may be difficult for the VMG to implement in the field. The labour cost of adopting this technology might be out of reach for the VMGs thus affecting adoption and scaling up The technology demands proper training and access to information to enable proper implementation. This might be lacking among the VMGs Limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities Low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities exist for unemployed youth exists in provision of labour
E: Case studies/profiles of succe	ess stories
Success stories, if any	Over 50,000 smallholder farmers in lower Eastern counties of Kenya are recording a more than doubling of yields and reduced soil erosion after embracing a soil conservation scheme that involves digging of trenches in hillside to trap runaway water and soil.
Application guidelines for users	A guide for selecting the right soil and water conservation practices for small-holder farming in Africa. Technical manual No. 24. World Agroforestry Center (ICRAF).
F: Status of TIMP readiness (1. Ready for upscaling, 2=Requires validation; 3=Requires further research)	1. Ready for up scaling
G: Contacts	
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Partner organizations and contacts	County Governments extension service.

Requires validation in new areas not practised

2.6.5 Stone lines

TIMP name	Stone lines
Category (technology, innovation or management practice)	Management practice
A: Description of the technolog	y, innovation or management practice
Problem to be addressed	The risk of soil erosion and increased run off; low soil water retention capacity in most soils
What is it? (TIMP description)	Stone lines are stones placed along contour lines to slow down runoff. With time, the soil builds up on the upslope side of the stone line and a natural terrace is formed. The technology is suitable in gentle to moderate slopes (less than 10%); areas with low annual rainfall areas (200 - 750 mm); and stony areas
Justification	The impacts of climate change such as low and erratic rainfall continue to threaten agricultural production, food security and livelihoods especially in the ASALs. Agricultural production is threatened in many parts of the Kenya by soil erosion and limited soil moisture. Stone lines can help in the conservation of soil and moisture.
B: Assessment of dissemination	and scaling up/out approaches
Users of TIMP	Farmers
Approaches to be used in dissemination	Farmer Field and Business School (FFBS)Agricultural innovation platforms (AIP)
	Demonstrations - On-farm and on station
	• Agricultural snows/exhibitions/field days
	Irainings - worksnops/Seminars/Meetings Dublic and private Extension A conta
	 Public and private Extension Agents Former to former extension models
	 Mass media - Electronic and print
	 Publications - posters/brochures/leaflets, manuals
	 Digital Platforms - Website, Dashboards, Apps, social media short message services
Critical/essential factors for	• Availability of labour as the technology is labour intensive

successful promotion	• Farmers and extension service with skills to design and
	construct stone lines
	• Land tenure systems that allows individual ownership
Partners/stakeholders for	• County government extension service providers –
scaling up and their roles	delivery of information to farmers, technology access,
	capacity building
	• Community farmer groups – Provide on farm demonstration
	plots to hold farmer field schools; provide collective labor
	• External service providers – capacity building and
	access to technology
C: Current situation and future	e scaling up
Counties where already promoted	Makueni, Machakos, Tharaka Nithi, Kakamega, Nyeri, Meru
County where TIMP will be	Lamu Kilifi and Kwale
promoted	
Challenge(s) in development and	• Increased risk of soil erosion if stone lines are improperly laid
dissemination	out
	• Labour intensive and many farmers may find it difficult
	to implement at large scale
	• Land tenure systems – communal land ownership, or lack
	of individual land ownership rights.
Suggestions for addressing the	• Farmers need to be supported with appropriate tools for
challenges	preparation and laying of stones lines for efficiency and
	increased output per man hour.
	• Training youthful farmers to be champions of laying stone
	lines and maintenance.
	• Training on site specific designs and laying of stone lines
Laggong loornad if any	 Fast-track land registration Evistance of well developed self help groups can lead
Lessons rearried, if any	• Existence of wen-developed sen-neip groups can lead
	 Conducting well publicized campaigns has been found to add
	to the success of soil and water conservation. Similarly, when
	the farmers are adequately trained and sensitized on the
	technology many of them would be willing to invest
	teennology, many of them would be writing to invest.
Social, environmental, policy and	• Enforce policies on soil and water conservation at the
market conditions necessary	County level
	• Create awareness on the importance of soil and
	water conservation
	• Avail low-cost technologies for soil and water conservation
	• Formulate policies that support individual land tenure systems
D: Economic, gender, vulnerabl	le and marginalized groups (VMGs) considerations
Basic costs	For each hectare, transport and other project costs amount to around KES 25.000.
Estimated returns	Yet to be determined
Gender issues and concerns in	• The technology is labour intensive therefore may increase
development, dissemination,	women labour burden
adoption and scaling up	• Women have less access to agricultural information,
	technology and knowledge

	• Women and youth have limited access to productive resources
	such as land, quality seed and credit
	 Women and youth have limited access to education training
	and extension services than men
	 Men dominate most decisions at the household and
	community levels
Gender related	Potential to create employment for youth through provision of
opportunities	the labour required
VMG issues and concerns in	• Less access to agricultural information, technology and
development, dissemination,	knowledge
adoption and scaling up	• Limited access to productive resources such as land, credit, and quality seed
	• Limited access to training and extension services
	• Due to their social status VMGs are often excluded from
	decision making in development and dissemination activities
	• Low adoption by VMGs due lack of awareness
VMG related	 Departunities exist for youth in provision of labour.
opportunities	• Opportunities exist for youth in provision of fabour
E: Case studies/profiles of succe	ess stories
Success stories if any	In Burkina Faso farmers have reported doubled cereal production
Success stories, if any	when stone lines are used in combination with greater use of
	compost as fertilizer.
	https://www.rural21.com/fileadmin/_migrated/content_uploads/Stone
	_lines_against_desertification_01.pdf
Application guidelines for	Stone lines are built along the contours. The lines are between 0.5
users	and
	1.5 m high, depending on the gradient of the slope. The distance
	between stone lines ranges from 25 to 40 m. Each hectare needs
	between 30 and 50 tons of stones, which are built into contour lines
	about 300 m long. The stone lines slow the fast-flowing rainwater,
	thereby reducing erosion. This allows up to 200 more litres of
	water to penetrate the soil per square metre. The amount of work
	involved is considerable: to quarry the stone load it onto lorries
	and line it on the fields
E: Status of TIMD readingss (1	1 Deady for up scaling
F: Status of Hivir readiness (1.	1. Ready for up scaling
Ready for upscaling,	
2=Requires validation;	
3=Requires further research)	
G: Contacts	
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Lead organization and scientists	Malko: E. Mutuma; J. wamuongo; M, wairimu; P. Kitiem, J. Mwaura; D. Kamau and A.O. Esilaba.
Partner organizations and	County Governments extension service, NGOs.
contacts	

TIMP name	Retention ditches
Category (technology, innovation or management practice)	Management practices
A: Description of the technolog	y, innovation or management practice
Problem to be addressed	The risk of soil erosion and increased run off
What is it? (TIMP description)	Retention ditches are trenches designed to catch and retain incoming runoff and hold it until it infiltrates into the ground. They can be an alternative to waterways in high rainfall areas, but they are most often used in semi-arid areas to harvest water. The technology is suitable in semi-arid areas; permeable, deep and stable soils; and on flat or gentle sloping land.
Justification B: Assessment of dissemination	The impacts of climate change such as low and erratic rainfall continue to threaten agricultural production, food security and livelihoods especially in the ASALs. Agricultural production is threatened in many parts of the Kenya by soil erosion and limited soil moisture. Conservation of soil and moisture through construction of retention ditches has led to better and more reliable crop yields. and scaling up/out approaches
Users of TIMP	Farmers
Approaches to be used in dissemination Critical/essential factors for successful promotion	 Farmer Field and Business School (FFBS) Agricultural innovation platforms (AIP) Demonstrations - On-farm and on station Agricultural shows/exhibitions/field days Trainings - workshops/Seminars/Meetings Public and private Extension Agents Farmer-to-farmer extension models Mass media - Electronic and print Publications - posters/brochures/leaflets, manuals Digital Platforms - Website, Dashboards, Apps, social media short message services Availability of labour as the technology is labour intensive. Farmers and extension service with skills to design and
successful promotion	 Farmers and extension service with skills to design and construct retention ditches Land tenure systems that allows individual ownership
Partners/stakeholders for scaling up and their roles C: Current situation and future	 County government extension service providers – delivery of information to farmers, technology access, capacity building Community farmer groups – establishment of on-farm demonstration plots to hold farmer field schools; provide collective labor External service providers – capacity building and access to technology

2.6.6 Retention ditches

Counties where already promoted if any	Makueni, Machakos, Tharaka Nithi, Kakamega, Nyeri, Meru
County where TIMP will be promoted	Lamu, Kilifi and Kwale
Challenge(s) in development and dissemination	 Increased risk of soil erosion if retention ditches are improperly laid out Labour intensive and many farmers may find it difficult to implement at large scale Land tenure systems – communal land ownership, or lack of individual land ownership rights.
Suggestions for addressing the challenges	 Farmers need to be supported with appropriate tools for digging out retention ditches for efficiency and increased output per man hour. Training youthful farmers to be champions of digging out retention ditches. Training on site specific designs and layout Fast-track land registration
Lessons learned, if any	When the farmers are adequately trained and sensitized on the technology, many of them would be willing to invest
Social, environmental, policy and market conditions necessary	 Enforce policies on soil and water conservation at the county level Create awareness on the importance of soil and water conservation Avail low cost technologies for soil and water conservation Formulate policies that support individual land tenure systems
D: Economic, gender, vulnerabl	e and marginalized groups (VMGs) considerations
Basic costs Estimated returns	The main input cost is the labour for digging retention ditches as dictated by the land size and the landscape terrain/slope. A current market price of labor of KES. 450/= per man-day applies Yet to be determined
Gender issues and concerns in development, dissemination, adoption and scaling up	 The technology is labour intensive therefore may increase women labour burden Women have less access to agricultural information, technology and knowledge Women and youth have limited access to productive resources such as land, quality seed and credit Women and youth have limited access to education, training and extension services than men Men dominate most decisions at the household and community levels
Gender related	Potential to create employment for youth through
VMG issues and concerns in development and dissemination	 provision of the labour required The technology is labour intense and may be difficult for the VMG to implement in the field. The labour cost of adopting this technology might be out of reach for the VMGs thus affecting adoption and scaling up

	• The technology demands proper training and access to
	information to enable proper implementation. This
	might be lacking among the VMGs
	• Limited access to training and extension services
	• Due to their social status VMGs are often excluded
	from decision making in development and
	dissemination activities
	• Low adoption by VMGs due lack of awareness
VMG related opportunities	Application of retention ditch ridge is expected to improve
	agriculture production thus, more food and income for the
	VGMs.
E: Case studies/profiles of succe	ess stories
Success stories, if any	Over 50,000 smallholder farmers in Eastern and Central Kenya are
	recording a more than double of yields and reduced soil erosion
	after embracing a soil conservation scheme that involves digging
	of retention trenches in hillside to trap runaway water and soil.
Application guidelines for	A guide for selecting the right soil and water conservation practices
users	for small-holder farming in Africa. Technical manual No. 24. World
	Agroforestry Center (ICRAF).
F: Status of TIMP 1. R	eady for up scaling
readiness (1. Ready for	
upscaling.	
2=Requires validation:	
3=Requires further	
research)	
G: Contacts	
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Partner organizations and	County Governments extension service.
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2.6.7 Grass strips

TIMP name	Grass strips
Category (technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	The risk of soil erosion and increased run off
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What is it? (TIMP description)	Grass strips are dense strips of grass panted up to a meter wide, along a contour. With time, silt builds up above the strip and benches are formed. Grass strips can be planted along ditches to stabilize them, or on the rises of bench terraces to prevent erosion. They are a popular and easy way to terrace land, especially in areas with relatively good rainfall. The technology is suitable in regions with fairly gentle slopes (0 - 6%); grass is needed for fodder; and high rainfall areas.
Justification	by soil moisture stress and serious soil erosion. Conservation of soil and moisture through construction of grass strips has led to better and more reliable crop yields
B: Assessment of dissemination	and scaling up/out approaches
Users of TIMP	Farmers
Approaches to be used in dissemination Critical/essential factors for successful promotion	 Farmer Field and Business School (FFBS) Agricultural innovation platforms (AIP) Demonstrations - On-farm and on station Agricultural shows/exhibitions/field days Trainings - workshops/Seminars/Meetings Public and private Extension Agents Farmer-to-farmer extension models Mass media - Electronic and print Publications - posters/brochures/leaflets, manuals Digital Platforms - Website, Dashboards, Apps, social media short message services. Availability of labour Availability of land, apart from cropland. Farmers and extension service with skills to design and construct grass strips Land tenure systems that allows individual ownership
Partners/stakeholders for scaling up and their roles	 County government extension service providers – delivery of information to farmers, technology access, capacity building Community farmer groups – Provide on farm demonstration plots to hold farmer field schools; provide collective labor. External service providers – capacity building and access to technology
C: Current situation and future	scaling up
Counties where already promoted if any	Makueni, Machakos, Tharaka Nithi, Kakamega, Nyeri, Meru
County where TIMP will be promoted	Lamu, Kilifi and Kwale
Challenge(s) in development and dissemination	 Labour intensive for maintaining and controlling grass from becoming a weed Reduced land area for crop production

Suggestions for addressing the	• Farmers need to be supported with appropriate tools and
challenges	suitable grass varieties.
	• Capacity building on the maintenance of grass strips
	Training on site specific designs and layout
Lessons learned, if any	• Establishment of grass strips induces a process of natural
	terracing on slopes as soil collects behind the grass barrier,
	even in the first year.
	• Grass strips can be very appropriate for farmers who cut and
	carry fodder for their animals.
	• Grasses are also used as mulch for crops by farmers.
Social, environmental, policy and	• Enforce policies on soil and water conservation at the
market conditions necessary	County level
	Create awareness on the importance of son and water conservation
	• Avail low cost technologies for soil and water conservation
D: Economic, gender, vulnerab	e and marginalized groups (VMGs) considerations
Basic costs	The main input cost is the labor for establishing grass strips. The
Basic costs	cost
	will depend on the type of grass to be planted land size and the
	landscape terrain/slope
Estimated returns	Yet to be determined
Gender issues and concerns in	• Limited ownership of or access to land may limit women
development dissemination	from technology implementation
adoption and scaling up	• Limited power in making decisions on land use may limit
adoption and searing up	women in technology adoption
	• The technology is labour intensive and may limit
	implementation by women
	• Differing accessibility to information between men and
	women because of gender norms that place access to new
	information and technologies in the hands of male heads of
	will affect adoption and scaling up.
	• Limited access to appropriate tools and credit may limit
	application of technology among specific gender
	including
~	Women
Gender related opportunities	• The technology is labour intensive therefore may increase
	women labour burden
	• Women have less access to agricultural information,
	Woman and youth have limited access to productive resources
	• women and yourn have infined access to productive resources such as land, quality seed and gradit
	• Women and youth have limited access to education training
	and extension services than men
	 Men dominant most decisions at the household and community
	levels
VMG issues and concerns in	Potential to create employment for youth through provision of
development	the labour required
and dissemination	1
VMG related opportunities	• The technology is labour intense and may be difficult for the

	VMG to implement in the field.
	• The labour cost of adopting this technology might be out of
	reach for the VMGs thus affecting adoption and scaling up
	• The technology demands proper training and access to
	information to enable proper implementation. This might be
	lacking among the VMGs
	 Limited access to training and extension services
	 Due to their social status VMGs are often excluded from
	decision making in development and dissemination activities
	 Low adoption by VMGs due lack of awareness
E: Case studies/profiles of succ	ess stories
Success stories if any	Farmers have reported improved reduced runoff and nutrient
	loss soil moisture retention in the soil and generally an increased
	crop production following application of this widely used and
	readily available management practice
	reading available management practice
Application guidelines for	A guide for selecting the right soil and water conservation practices
users	for small-holder farming in Africa. Technical manual No. 24. World
	Agroforestry Center (ICRAF).
F: Status of TIMP readiness (1.	1. Ready for up scaling
Ready for upscaling, 2=Requires	
validation;	
3=Requires further research)	
G: Contacts	
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Scientists	Mwaura; D. Kamau and A.O. Esilaba.
Partner organizations and	County Governments extension service.
Contacts	-

2.6.8	Tied ri	dges /R	idging	/Earthing
_ •••••	I ICU I I	uges / 11	using /	Laiting

TIMP name	Tied ridges /Ridging /Earthing	
Category (technology, innovation or management practice)	Management practice	
A: Description of the technology, innovation or management practice		
Problem to be addressed	Crop water stresses in production; Increased water losses in the furrows	
What is it? (TIMP description)	Tied ridges are small earthen ridges, 30 cm high, with an upslope furrow which accommodates water between the ridges.	

	Technology consist of water flowing down the small
	trenches/furrows running parallel and infiltrates into crop root
	zones. Water is applied to the top end of each furrow and flows
	down the crop field under the influence of gravity.
Justification	With limitations in soil moisture due to decreasing rainfall
	occasioned by climatic changes, tied ridges helps conserve soil
	moisture. In combination with furrow irrigation, the technology has
	potential to improve agricultural productivity and increase crop
	yields and cropping intensities. As a result, household food security,
	incomes and livelihoods are enhanced.
Region promoted	Tana River, Garissa, and West Pokot counties
B: Assessment of dissemination	and scaling up/out approaches
Users of TIMP	Farmers
Approaches used in	• Farmer Field and Business School (FFBS)
dissemination	• Agricultural innovation platforms (AIP)
	 Demonstrations - On-farm and on station
	• A grigultural shows/ayhibitions/field days
	• Agricultural shows/exhibitions/netd days
	• Trainings - workshops/Seminars/Meetings
	• Public and private Extension Agents
	• Farmer-to-farmer extension models
	Mass media - Electronic and print
	• Publications - posters/brochures/leaflets, manuals
	 Digital Platforms - Website, Dashboards, Apps, social media short message services
Critical/essential factors for	• Proximity to water sources - close to permanent
successful promotion	water sources
	• Suitable topography of area (level land)
	Technical capacity for maintenance
Partners/stakeholders for	 County government – capacity building
scaling up and their roles	• Private sector – access to credit, capacity building
	 NGOs (Kenya Red Cross (KRC), Action Aid, World
	Vision, and OXFAM) – capacity building, credit facilities,
	facilitate technology access
	• National Irrigation Board – technology access and capacity
	building
	• Water Resources Management Authority – Water
C: Current situation and future	resources use management
Counting where already	Maluani Mashaltaa Thamla Nithi Kalamaga Nyani Mam
promoted if any	Makucin, Machakos, Thataka Mulli, Kakamega, Myeri, Meru
County where TIMP will be	Lamu, Kilifi and Kwale
promoted	
Challenges in dissemination	• Can be labour intensive during establishment phase
	• Poor management may lead to water use inefficiencies
	• Limited access to credit may limit uptake
	• Land tenure insecurity in some counties limits adoption and

	investments
Recommendations for addressing	• Enhancing farmers' capacity to see benefits
the challenges	• Capacity building farmers on establishment and maintaince of the
	ridges
	• Enhance access to credit services
	Implement policy on land use and tenure
Lessons learned	• Use of tied ridges with furrow irrigation significantly
	increases yields
	Poor management and designs may often result in flooding of low areas
	• Assessment of soil erosion and sediment is key to
	sustainability
Social, environmental, policy and	• The economics of furrow irrigation needs to be well articulated
market conditions necessary	• Enhanced land quality control to mitigate against soil salinity
	• Adequate policies and guidelines regarding water abstraction
	from the main water sources to minimize resource conflicts
	especially along river downstream.
	• Market for the crops produced under irrigation should be
	identified early enough to minimize losses and increase
	profitability from the system
D: Economic, gender, vulnerab	le and marginalized groups (VMGs) considerations
Basic costs	Not known *(Research gap)
Estimated returns	Depend on the response enterprise
Gender issues and concerns in	• The technology is labour intensive therefore may increase
development, dissemination,	women labour burden
adoption and scaling up	• Women have less access to agricultural information,
	technology and knowledge
	• Women and youth have limited access to productive
	resources such as land, quality seed and credit
	• Women and youth have limited access to education, training
	and extension services than men
	• Men dominate most decisions at the household and
	community levels
Gender issues and concerns in	• Potential to create employment for youth through
development, dissemination,	provision of the labour required
adoption and scaling up	
Gender related opportunities	• The technology is labour intense and may be difficult for the VMG to implement in the field
	The labour cost of adopting this technology might be out of
	• The labour cost of adopting this technology high be out of reach for the VMGs thus affecting adoption and scaling up
	The technology demands proper training and access to
	information to enable proper implementation. This might be
	lacking among the VMGs
	• Limited access to training and extension services
	• Due to their social status VMGs are often excluded from
	decision making in development and dissemination
	activities

	• Low adoption by VMGs due lack of awareness
VMG issues and concerns in	• Opportunities exist for youth exists in provision of
development and dissemination	labour
VMG related opportunities	 The technology is labour intensive therefore may increase women labour burden Women have less access to agricultural information, technology and knowledge Women and youth have limited access to productive resources such as land, quality seed and credit Women and youth have limited access to education, training and extension services than men Men dominate most decisions at the household and community levels
E: Case studies/profiles of succe	ess stories
Success stories	There are successful models for such technology (Mwea and Perkerra irrigation schemes) where furrow irrigation systems have provided opportunities for local community to produce high value crops. A sound understanding of the roles and responsibilities of farmers and water user associations is a feature of successful system.
Application guidelines for users F: Status of TIMP readiness (1. Ready for up scaling, 2. Requires validation, 3. Requires further research)	 Sijali I V. Drip irrigation: options for smallholder farmers in Eastern and southern Africa. 2001. RELMA Technical Handbook Series 24. Nairobi, Kenya: Regional Land Management Unit (RELMA), Swedish International Development Cooperation Agency, (Sida). 60 p. + x p.; includes Bibliography FAO CSA Manual FAO Irrigation Water Management: Irrigation Manual GoK MoALD: Training Manual for Water Users Association and farmers Ready for up scaling
G: Contacts	
Contacts	Director, Environment & Natural Resources KALRO Secretariat Institute Director, KALRO –ICRI Mtwapa, Kalro.Mtwapa@kalro.org
Lead organization and scientists	KALRO: Mwaura J., Sijali I.
Partner organizations and contacts	National Irrigation Board (NIB), Water Resources Management Authority

GAPS The economic viability of the technology in different agro ecological zones need to be done

TIMP name	Rain water harvesting systems (roof catchment)
Category (technology, innovation or management practice)	Management practice
A: Description of the technolog	y, innovation or management practice
Problem to be addressed:	Water scarcity for crop and livestock use especially in the face of diminishing rainfall because of climate change
What is it? (TIMP description)	Rain water harvesting is a technique of collection and storage of rainwater into natural reservoirs or tanks, or the infiltration of surface water into subsurface aquifers (before it is lost as surface runoff). A vast number of techniques allow flexibility and adaptability to site-specific situations to best fight water scarcity and make agricultural production more resilient. One method of rainwater harvesting is rooftop harvesting and harvesting through earth dams.
Justification	By collecting, storing and utilizing water agricultural purposes, farmers are able to prevent soil erosion, stabilize water supply, and reduce reliance on other water sources. Smallholder farmers can also recoup initial investment costs in water harvesting by planting high-value crops, and extending their growing season through the entire year. Technology also slows water runoff and increases yields with the additional water.
B: Assessment of dissemination	and scaling up/out approaches
Users of TIMP	Farmers, pastoralists and agro-pastoralist
Approaches to be used in	Farmer Field and Business School (FFBS)
dissemination	Agricultural innovation platforms (AIP)
	• Demonstrations - On-farm and on station
	Agricultural shows/exhibitions/field days
	• Trainings - workshops/Seminars/Meetings
	Public and private Extension Agents
	Farmer-to-farmer extension models
	Mass media - Electronic and print
	• Publications - posters/brochures/leaflets, manuals
	• Digital Platforms - Website, Dashboards, Apps, social media short message services
Critical/essential factors for successful promotion	 Avail resources (human, technical and financial) to support acquisition and establishment of water harvesting systems Policy to support use of communal land to establish and manage the earth dams Policies supporting Public-Private Partnerships in water harvesting Sensitization of local communities to embrace the practice
Partners/stakeholders for	 Sensitization of local communities to embrace the practice Private sector – access to technology access to credit
scaling up and their roles	technology installation

2.6.9 Rain water harvesting systems (roof catchment)

	 County government – capacity building, policy support, aradit facilities
	 NGOs – access to technologies capacity building
	technology installation
C: Current situation and future	scaling up
Counties where already promoted	Most counties are investing on water harvesting technology at
	community level. More is required to increase uptake at household
County where TIMP will be	Lamu Kilifi and Kwale
promoted	Lanu, Kimi and Kwale
Challenges in dissemination	High costs related to technology access and management
	• Resource use conflicts where land is communally owned
	• Limited skills in technology installation and management
	• Limited community mobilization policy for water related
	activities
	 Lack of proper water usage and control measures
	 In the case of earth dams where there is a lot of siltation,
	regular de-siltation is required.
	Threats to sustainability of established systems because of lack
	maintenance
	Vandalism
	• Some systems require high investment costs.
Suggestions for addressing the	• Resource mobilization through partnerships with private
challenges	sector
	• Engaging a participatory process during the planning and
	Implementation of the project.
	• Oser specific training programs water harvesting technologies maintenance and operation skills
	 Cost of buying water harvesting structures is very high for
	most households and needs to be reviewed
	Securing systems to prevent vandalism
Lessons learned in upscaling, if	Potential to caution community against water scarcity
any	• Improved productivity where water harvesting has been
Social environmental policy and	Devise systems that are gender sensitive target different
market conditions necessary	gender needs
	• Carry out environment and social impact assessment of the
	technology in specific counties and cultures
	• Support structures that help access to credit for technology
	access and maintenance
	 Enact Policy frameworks to support water harvesting Enact policies on land tonurs systems to support water
	harvesting
D: Economic, gender, vulnerabl	le and marginalized groups (VMGs) considerations
Basic costs	• Not determined (research gap existing)
	• Not affordable to most rural households.
Estimated returns	• Needs to be determined on a case-by-case basis with

	respect to the farm terrain and desired scale of water
	harvesting
	-
Gender issues and concerns in	• The technology is labour intensive and may limit
development and dissemination	implementation by women
	• Once implemented the technology will reduce time used by
	women to fetch for water. This time may be used for other
	productive activities
	 Women have less access to information, technology and knowledge
	• Women and youth have limited access to the equipment used
	to make the water pan than men
	• Women have less access to land that can be used for water pan than men
	• Women and youth have limited access to education training
	and extension services than men
	• Men dominate most decisions at the household and
	community levels
Gender related opportunities	Potential to create reduce women work burden in
	fetching water so that they can perform other productive tasks
VMG issues and concerns	• The technology is labour intensive and may limit
in development,	implementation by women
dissemination, adoption	• Less access to agricultural information, technology and
and scaling up	knowledge
	• Limited access to productive resources such as land, credit, and quality seed
	• Limited access to training and extension services
	• Due to their social status VMGs are often excluded from
	decision making in development and dissemination
	activities
	• Low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities exist for youth in provision of labour for the
	TIMP
E: Case studies/profiles of succe	ess stories
Success stories	Agro-pastoralists who adopted water harvesting technology have
	had sustained source of income and improved livelihoods
	A typical African Water Bank rainwater harvesting system collects
	400,000 to 450,000 litres of rainwater within two to three hours of
	steady rain. It has an artificial roof of 900 to 1,600 square metres and
	storage tanks. The largest tank constructed in Narok County has a
	capacity of 600,000 litres.
	This amount of water can serve a community of 400 people for
	approximately 24 months without extra rain. The capacity can be
	added at a rate of 220,000 litres per year. The system is low cost and
	can be 100 percent maintained locally. It also uses local skills,
	labour, materials and technology. Apart from boosting access to
	water in arid and semi regions, rainwater harvesting contributes to

	water conservation thus reducing overexploitation of water
	resources.
Application guidelines for users	1. Handbook on Rainwater Harvesting and Storage Options
	2. Manual for Rooftop Rainwater Harvesting Systems in the
	Republic of Yemen
F: Status of TIMP readiness (1.	1. Ready for upscaling
Ready for up scaling, 2. Requires	
validation	
3. Requires further research)	
G: Contacts	
Contacts	1. Director, Environment & Natural Resources KALRO Secretariat
	2. Institute Director, KALRO –ICRI Mtwapa
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Partner organizations and	County government, PPP
contacts	

1. Development of models of rain water harvesting for intensive agricultural production and household use.

TIMP name	Conservation Agriculture (CA)
Category (technology,	Innovation
innovation or management	
A: Description of the technolog	y, innovation or management practice
Problem to be addressed:	Land degradation characterized by the declining soil fertility, low
	yields, increased soil moisture stress, increased soil erosion and loss
	of biodiversity
What is it? (TIMP description)	Conservation agriculture is management practice which maximizes on saving water on the farming by adhering to specific principles that govern it. The practices that make up this approach follow key principles that target to conserve the soil, soil moisture, and soil-nutrients, and stabilize land production while reducing production costs.
	Conservation agriculture principles are: 1. Minimal soil disturbance, 2. Permanent ground cover - maintenance of a mulch of carbon-rich organic matter covering and feeding the soil (including straw and/or other crop residues including cover crops), 3. Crop rotation or sequences and associations of crops including trees, which could include nitrogen-fixing Legumes.
Justification	Land productivity is decreasing leading to decreased yield. Continuous land operation continues to emit more GHGs (Carbon) responsible for the climatic changes. Conservation agriculture (CA) has potential to:
	 Enhance management of soil fertility and organic matter, and improvement of the efficiency of nutrient use, helping to produce more with proportionally less fertilizer Rotations and crop associations that include legumes are capable of hosting nitrogen-fixing bacteria in their roots; this contributes to optimum plant growth without increased GHG emissions induced by fertilizer production Avoidance of tillage minimizes occurrence of net losses of carbon dioxide by microbial respiration and oxidation of the soil organic matter and builds soil structure and bio pores through soil biota and roots
	 The protective soil cover of leaves, stems and stalks from the previous crop shields the soil surface from heat, wind and rain, keeps the soil cooler and reduces moisture losses by evaporation Helps to reduce soil compaction and plough pans and regenerates degraded lands
B: Assessment of dissemination	and scaling up/out approaches
Users of TIMP	Farmers, Extension Agents, Researchers
Approaches to be used in	• Farmer Field and Business School (FFBS)
dissemination	Agricultural innovation platforms (AIP)
	Demonstrations - On-farm and on station

2.6.10 Conservation Agriculture (CA)

	Agricultural shows/exhibitions/field days
	• Trainings - workshops/Seminars/Meetings
	• Public and private Extension Agents
	• Farmer-to-farmer extension models
	 Mass media - Electronic and print
	Dublications posters/brochuros/loaflats manuals
	• Fublications - posters/biochures/reariets, manuals
	message services
Critical/essential factors for	• Training on principles and benefits of CA
successful promotion	Model demonstration using crops
Partners/stakeholders for scaling	• County Extension officers - Dissemination of information,
up, their roles and stage of	capacity building
involvement	• NGO's (African Conservation Network, One Acre Fund)-
	Capacity Building, Dissemination of information
	• CIAT, FAO – capacity building
	County Governments - Funding CA activities, support
	capacity building, enabling environment and supportive
	policies
C: Current situation and future	e scaling up
Counties where already	Bungoma, Meru, Embu, Tharaka Nithi, Laikipia, Kakamega
Country and any TD (D and the	
county where TIMP will be	Lamu, Kiim and Kwale.
Challenges in dissemination	• Non-availability of crop residue in suitable quantities
chancinges in dissemination	 Competition for crop residues with other uses like wood fuel
	and livestock
	• Land tenure (farmers reluctant to invest in CA where they
	do not have clear land rights)
	• Limited knowledge on the incremental benefits of CA
	Limited access to CA implements
Suggestions for addressing the	• Encourage farmers to expand biodiversity in the farms
challenges	• Enhance Public Private Partnerships (PPP) to support
	increased production and market access
	• Improve KALRO and County government capacity to train
	and re-tool technical team so as to enhance uptake of the
	technology
	 Allocation of more funds for continued research and
	dissemination of this technology would aid increased uptake
	of CA with agroforestry
	• Fast-track land registration process
Lessons learned in unscaling if	• Untake of CA technology increases with the realized
anv	incremental benefits over time
	Continuous capacity building increases CA technology
	uptake
Social, environmental, policy and	• Develop Integrated Herbicide Management Plan – pre-
market conditions necessary for	emergence and post-emergence herbicides
development and dissemination	• Reliable technology adoption and suitable price and market
	access for produce under CA

	Continuous capacity building of the community on the	
	benefits of CA technology	
	 County poncies that support nouseholds investing in CA with inputs like implements 	
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations		
Basic costs	Costs related to ripping services and herbicides amount to KES	
	5000/acre. This is apart from the normal inputs of seed and	
	fertilizer when establishing. Generally, a knowledge gap exists.	
Estimated returns	Reduction of costs associated with tillage-induced soil	
	erosion and degradation (40% of land degradation)	
	• Returns on conserving soil exceeding 150 ton/hectare	
Conder issues and concerns in	annually and associated increased productivity	
development dissemination	• CA with frees is a management practice that that is menory for all the gender categories	
adoption and scaling up	 Reduces labor demands for women who perform most of the 	
and the second second second second	crop's production activities	
	• Women have less access to land than men	
	• Women and youth have limited access to the equipment used	
	for CA than men	
	• Women have limited access to education, training and	
	• Men dominate most decisions at the household and	
	• Men dominate most decisions at the nodsenoid and community levels	
Gender related opportunities	CA Reduces women workload so that they can venture in other	
VMG issues and	economic activities	
concerns in	• Less access to agricultural information, technology and	
development,	knowledge	
dissemination, adoption	• Limited access to productive resources such as land, credit,	
and scaling up	and quality seed	
	• Limited access to training and extension services	
	• Due to their social status vMGs are often excluded from decision making in development and dissemination activities	
	• Low adoption by VMGs due lack of awareness	
VMG related opportunities	CA Reduces women workload so that they can venture in other	
	economic activities	
E: Case studies/profiles of success stories		
Success stories from previous	Farmers and agro-pastoralists who adopt the technology have	
similar projects	had sustainable source of income and increased resilience	
Application guidelines for users	1. Okoba, B. (2018), Climate-Smart Agriculture: Training	
	Manual for Agricultural Extension Agents in Kenya.	
	2. ESHADA, E.U (2019), KUEP-UKAL USA Extension Manual 3. SUSTAINET FA (2010). Technical Manual for formers and	
	Field Extension Service Providers: Conservation Agriculture	
	Sustainable Agriculture Information Initiative, Nairobi	
F: Status of TIMP	1. Ready for up scaling	
readiness		
G. Contacts		

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Partner organizations and	County government, Private Public Partnerships
contacts	

- 1. Identification of the most suitable diversified crop rotations and suitable crops for biomass for the different counties.
- 2. Development of suitable CA implements/field equipment prototypes.
- 3. Capacity building on the benefits and operationalization of Conservation Agriculture systems both among extension and technical staff, and at decision-making levels:

2.6.11	Cashew/Legume	Intercronning
4.0.11	Cashe w/ Legune	marcropping

TIMP name	Cashew/Legume Intercropping
Category (technology, innovation or management practice)	Management practice
A: Description of the technolog	y, innovation or management practice
Problem to be addressed:	Monoculture agricultural practices are normally accompanied by decreased yields, hence low farm returns. This arises from soil degradation and declining soil fertility that result from soil erosion. Cashew-legume intercropping will minimize surface runoff and resultant soil erosion, weeds infestation reduced by cover crops and vulnerability to crop pests as the practice helps slow down proliferation of pests leading to enhanced yields.
What is it? (TIMP description)	 Intercropping is a multiple cropping practice involving growing two or more crops together. The most common goal of intercropping is to produce a greater yield on a given piece of land by making use of resources or ecological processes that would otherwise not be utilized by a single crop. The practice offers the potential to increase yields, enhance soil fertility and minimize the effects of climate change. Single row intercropping: involves the component of cashew and the legumes including (<i>Mucuna pruriens</i>, Dolichos Lab lab, Cowpeas, <i>Clitoria ternatea</i> arranged in alternate single rows. Spacing - The space between the two cashew rows is 12 m and the legume is planted in between.

	alternated with single or several rows of cashew.
	Spacing - The inter-row spacing between legumes is 50-60 cm and
	legume to cashew 1s 60 cm. The space between two cashew rows
Instification	18.12 m.
Justification	Climate change is negatively impacting agricultural productions.
	fertility and generally low farm returns from their investments
	Intercropping is one of the potential management practice of
	enhancing climate change adaptation. It offers the potential to
	increase yield, enhance soil fertility/biodiversity and minimize the
	effects of climate change.
	The practice is known to build healthy soils, control weeds and
	harness a variety of benefits to increase yields. Intercropping of
	compatible plants encourages biodiversity by providing a habitat
	for a variety of insects and soil organisms that would not be present
	in a single-crop environment.
	The practice has several advantages. First, an intercrop may use
	resources of light, water, and nutrients more efficiently than single
	crops planted in separate areas, and this can improve yields and income
	Secondly, crop mixtures frequently have lower pest densities,
	especially of insect pests. This occurs both because the mixture
	confuses the insects and, if chosen carefully attracts beneficial
	predators. Finally, intercropping may allow more effective
	management of cover crops.
B: Assessment of dissemination	and scaling up/out approaches
Users of TIMP	Farmers and wide range of users
Approaches to be used in	Farmer Field and Business School (FFBS)
Dissemination	Agricultural innovation platforms (AIP)
	• Demonstrations - On-farm and on station
	Agricultural shows/exhibitions/field days
	Trainings - workshops/Seminars/Meetings
	Public and private Extension Agents
	• Farmer-to-farmer extension models
	Mass media - Electronic and print
	• Publications - posters/brochures/leaflets, manuals
	• Digital Platforms - Website, Dashboards, Apps, social media
	short message services
Critical/essential factors for	• Awareness creation on the benefits and contribution of
successful promotion	the practice to all stakeholders
	• Easy access of legume varieties that are compatible
	with cashew
	• Technical packages describing appropriate schedules
	or planning intercrop

	Deckage on fartilizer rates and regimes under the practice
	• Package on refunzer fates and regimes under the practice
Partners/stakeholders for scaling	 County Extension officers - Dissemination of
up and their roles	information, capacity building
	• NGO's (African Conservation Network, One Acre Fund)-
	Capacity Building, Dissemination of information
	• CIAT FAO – capacity building
	 County Covernments Europing CA activities support
	• County Governments - Funding CA activities, support
	capacity bunding, enabling environment and supportive
C. Current situation and future	
C: Current situation and future scaling up	
Counties where already promoted	Most counties in the medium to high rainfall areas & arid and
	semi-arid areas
County where TIMP will be up	Lamu, Kilifi and Kwale
scaled	
Challenges in dissemination	• Limited access and wide distribution of clean
	planting materials (intercrop varieties)
	• Inadequate access of technical materials on the
	establishment, operations and management of intercrop
	management practice by farmers
	• The increased effects of climate change hindering adoption
	• Former high neverty levels counted with illitereey
	• Farmer high poverty levels coupled with initeracy
	especially in deep rural areas of Kenya
Suggestions for addressing the	• Enhance access of clean planting materials across the
challenges	counties. Work closely with certified seed merchants,
	research institutions
	• Train and sensitize farmers on the basic principles of
	intercropping, their benefits and types suitable to
	their contexts using farmer field and business
	schools and demonstrations
	 Develop a comprehensive manual on the practice to guide
	the farmers during the adoption
Lessons learned in un eacling if	
Lessons learned in up- scaling, if	• The practice is very important in pest management.
any	Farmers can use a trap crop to attract pests, keeping them
	away from the main crop. Therefore, farmers can easily
	adopt this method to significantly cut down on pesticides
	input costs.
	• The number of ecological benefits provided by this
	practice can also accelerate up scaling. Intercropping
	promotes interactions between crops and pollinators, thus
	supporting biodiversity and wildlife species
Social environmental policy and	Socially acconted by both male and female conder
market conditions necessary	• Sociarry accepted by both mate and female gender
market conditions necessary	• The practice is environmentally friendly as it enhances
	biodiversity, controls erosion and minimizes use of
	pesticides
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	• A technology which involves evaluating trade-offs from
	an informed or research perspective

	• Comparatively eastly by between 25 500/ depending on	
	• Comparatively costly by between 25-50% depending on the legume mixes	
Estimated returns	 Dependent on the value chain intercrop 	
Gender issues and concerns in development, dissemination	 Women have less access to information, technology and knowledge Women and youth have limited access to the equipment 	
	used to make the water pan than menWomen have less access to land that can be used for water	
	 pan than men Women and youth have limited access to education, training and extension services than men 	
	Men dominate most decisions at the household and community levels	
Gender related opportunities	Intercropping offers good opportunities to both men and women to grow diverse crops for economic gains and at the same time offers enhanced biodiversity benefits	
VMG issues and concerns in development, dissemination,	• Less access to agricultural information, technology and knowledge	
adoption and scaling up	• Limited access to productive resources such as land, credit, and quality seed	
	• Limited access to training and extension services	
	 Due to their social status VMGs are often excluded from decision making in development and dissemination activities There is low adoption by VMGs due lack of awareness 	
VMG related opportunities	Intercropping places emphasis on the importance of using available land space to grow diverse of food crops, increase biodiversity, pest management thus the practice is economically viable for the VMGs	
E: Case studies/profiles of success stories		
Success stories	Farmers have reported improved soil conditions, reduced runoff and nutrient loss, soil moisture retention in the soil and generally an increased crop production following application of this widely used and readily available management practice.	
Application guidelines for users	Crop rotation on organic farms. A planning manual. SARE 2009.	
F: Status of TIMP	1. Ready for up scaling	
readiness	2. Requires validation	
G: Contacts	3. Requires further research	
Contacts	Director Environment & Natural Resources KALRO Secretariat	
Contacts	Institute Director, KALRO –ICRI Mtwapa Kalro.Mtwapa@kalro.org	
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Partner organizations and	County governments, KCEP-CRAL project	
contacto	iseli eisili piojee	

- 1. Major information GAPS on intercropping performances in specific areas of Kenya. For example, there hasn't been much research on optimal levels of fertilizer use for intercropping potatoes and legumes in some areas the need for site specific validation.
- 2. Little information on the interactions of various crop intercrops especially in the arid and semi-arid areas (ASALs).
- 3. Limited knowledge on resource-use efficiency particularly in regions with impoverished soils (ASALs) and economies where measured benefits is greatest.

TIMD nome	Mulahing
1 IVIP name	
Category (technology, innovation or management practice)	Management practice
A: Description of the technolog	y, innovation or management practice
Problem to be addressed	Accelerated loss of soil moisture-water stress in the soil. Suppression of weeds, loss of organic matter, managing salinity in ASALS.
What is it? (TIMP description)	The practice of covering the soil/ground with natural materials such as straw, dead leaves and compost to make more favourable conditions for plant growth, development and efficient crop production. Benefits: retain moisture in the soil; suppress weeds; keep the soil cool; and help improve soil fertility (as the mulches decompose).
Justification	Mulching facilitates retention of soil moisture and helps in control of temperature fluctuations, improves physical, chemical and biological properties of soil, as it adds nutrients to the soil and ultimately enhances the growth and yield of crops. It minimizes weed problems and nutrient loss. It also improves soil; structure directly by preventing raindrop impact and indirectly by promoting biological activity.
B: Assessment of dissemination	and scaling up/out approaches
Users of TIMP	Farmers
Approaches to be used in dissemination	 Farmer Field and Business School (FFBS) Agricultural innovation platforms (AIP) Demonstrations - On-farm and on station Agricultural shows/exhibitions/field days Trainings - workshops/Seminars/Meetings Public and private Extension Agents Farmer-to-farmer extension models

2.6.12 Mulching

•

Mass media - Electronic and print

	 Publications - posters/brochures/leaflets, manuals 	
	• Digital Platforms - Website, Dashboards, Apps, social media	
	short message services	
Critical/essential factors for	Availability of plant or crop residues	
successful promotion	• Size of the land	
	Competing uses of crop residues	
	• Type of the crops	
Partners/stakeholders for	County Extension officers - Dissemination of	
scaling up and their roles	information, capacity building	
	• NGO's (African Conservation Network, One Acre Fund)-	
	Capacity Building, Dissemination of information	
	 CIAT FAO – capacity building 	
	 County Governments - Funding CA activities support 	
	capacity building anabling anyironment extension services	
	provide link with formers and supportive policies	
	provide link with farmers and supportive policies	
	• Community farmer groups; play coordination role for ease in	
C: Current situation and future	problem identification and dissemination	
Counties where already	Baringo, Bomet, Kericho Tharaka Nithi, West Pokot, Nyeri,	
promoted	Machakos.	
County where the TIMP will be	Lamu	
upscaled		
Challenges in dissemination	• Lack of enough plant and crop residues due to	
	competing uses	
	• Possibilities of insect build up categorized as pest or disease	
Y 1 1		
Lessons learned	I nere is need to adapt to alternative mulching technologies	
	in addition to use of organic materials like crop, plant residues, and	
	agricultural processing wastes	
Social anvironmental policy	Dractice is socially acceptable	
and market conditions	 Fractice is socially acceptable Environmentally friendly 	
	 Environmentally mentally Increased productivity will provide supply to the 	
necessary	• Increased productivity will provide suppry to the	
	 Supporting frameworks/policies are available 	
D: Economic, gender, vulnerab	le and marginalized groups (VMGs) considerations	
Posie costa	This is low cost but lobour intensive during the initial	
Basic costs	• This is low cost but labour intensive during the initial application. Such costs are dependent on value chain and	
	application. Such costs are dependent on value chain and	
	 Specifics are not available hence there is a knowledge gap 	
Estimated returns	Dependent on value chain but generally $>100\%$ of the initial	
	investments.	
Gender issues and concerns in	• Since the activity is labour intensive it may increase the	
development, dissemination,	labour burden for the various gender categories	
adoption and scaling up	• The TIMP will reduce women's weeding time that can be used	
	performing other productive activities	
Gender related opportunities	The TIMP can offer employment for the youths	

VMG issues and concerns in	Though easy to use, it is be a bit labour intensive for VMGs,
development, dissemination,	hence its adoption and scaling up may be slow.
adoption and scaling up	
VMG related opportunities	Mulch is locally available on-farm and thus affordable implying
	that all including VMGs can take advantage of the practice
E: Case studies/profiles of succ	ess stories
Success stories	Farmers in different value chains have reported improved soil
	conditions, reduced runoff and nutrient loss, soil moisture retention
	in the soil and generally increased crop production following
	application of mulching technology
Application guidelines for users	A guide for selecting the right soil and water conservation practices
	for small-noider farming in Africa. Technical manual No. 24. World A greater (ICD A E)
E. Status of TIMD was dim ass	Agrororestry Center (ICKAF).
F: Status of ThviP readiness	1. Ready for up scaling
G: Contacts	
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Lead organization and scientists	KALRO: E. Mutuma, P. Ketiem, J. Mwaura, A. O. Esilaba, J.
	Wamuongo
Partner organizations and	County governments
contacts	Public-Private-Partnerships

GAPS:

Research on mulching using factory/industrial wastes, including mushroom, tea, coffee, among others in different value chains is required.

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2.6.13	Drip ir	rigation	systems	tor	small	scale	tarmers

TIMP name	Drip irrigation systems for small scale farmers
Category (technology, innovation or management practice)	Technology
A: Description of the technolog	y, innovation or management practice
Problem to be addressed	Increased crop water stress caused by rainfall variability in rain fed production systems
What is it? (TIMP description)	The technology supplements water during shortage of rainfall in crop production systems. It allows the optimal usage of the limited water resource by dripping water slowly into the crop roots at low

	pressure through a number of emission points (drippers). Drip system saves water by minimizing evaporation losses and delivering water at the root zone where it is required. It also provides the opportunity for farmers to increase crop yields. It is easy to design and operate. System provides efficient fertilizer usage (fertigation) with irrigation water.
	Layout of a drip irrigation system in vegetables
Justification	Mainstreaming drip irrigation systems into crop production provides the opportunity for farmers to enhance crop resilience, increase yields and incomes.
B: Assessment of dissemination	and scaling up/out approaches
Users of TIMP	Model Farmers
Approaches used in	Farmer Field and Business School (FFBS)
dissemination	Agricultural innovation platforms (AIP)
	• Demonstrations - On-farm and on station
	Agricultural shows/exhibitions/field days
	• Trainings - workshops/Seminars/Meetings
	Public and private Extension Agents
	• Farmer-to-farmer extension models
	• Mass media - Electronic and print
	• Publications - posters/brochures/leaflets, manuals
	• Digital Platforms - Website, Dashboards, Apps, social media
	short message services
Critical/essential factors for	• Correct field design (system installation) of the drip
successful promotion	system to minimize water inefficiencies.
	 Training of farmers and extension Drip management skills
Partners/stakeholders for	County governments; capacity building, supportive
scaling up and their roles	policies and frameworks
	• Private sector (AMIRAN); facilitate access to technology;
	technology demonstration; access to credit
	• NGOs (Kenya Red Cross- KRC, Action Aid, World Vision,
	technology demonstration
C: Current situation and future	e scaling up
Counties where already	Makueni, Bomet, Kajiado. Machakos
promoted, if any	

County where TIMP will be	Lamu, Kilifi and Kwale		
Challenges in dissemination	• Relatively high cost of drip kits for majority of poor		
	resource farmers in ASALs		
	• High temperatures experienced in ASALs cause water		
	salinity challenges		
	• Drip poly tubing also tend to collapse causing inadequate		
	water conveyance along the tube		
	• Limited knowledge on the drip irrigation technology		
	and its management		
Recommendations for addressing	• Avail affordable credits to resource poor farmers and		
the challenges	recover from produce		
	 Model farmer demonstration would create awareness and willingness to invest on the system 		
	• Modification of drin system tubes in ASAL groups is		
	• Mounication of unp system tubes in ASAL areas is required (use of PVC pipes) to manage clogging free flow		
	of water		
	• Regular maintenance of the system especially the drip filters		
	is required to flush out accumulated salts that tend to clog		
	emitters		
	• Intensive farmer training is required on the management		
	of drip irrigation system		
Lessons learned	• Drip system increases yield, incomes and food security		
	• Linking farmers with markets is critical for enhancing		
	sustainability		
	• Covering the soil with organic matter (crop residue or		
	green manures) in a drip system have also helped preserve moisture and additional nutrients to the soil		
	 It is also important to link farmers to Micro Finance. 		
	Institutions for financial needs		
Social, environmental, policy	• Capacity building for increased awareness		
and market conditions	• Policy support for increased investments in Drip irrigation		
necessary	systems		
	• The water quality should be known to adjust the drip		
	systems to avoid clogging		
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations			
Basic costs	• Two types of costs exist; investment (initial costs of		
	equipment) and operational costs which depend on the		
	type of value chain in question		
Estimated returns	 Specifics are not in place and need to worked on Income from drip system rises by as much as 35% stemming. 		
	from the management of crop water stresses.		
	• Increased water saving means more water is available for		
	other competing needs (domestic, livestock or industrial).		
Gender issues and concerns in	• Women and youth have limited access to, credit to purchase		
development, dissemination,	the drip irrigation kits than men		
adoption and scaling up	• Women have limited access to education, training and		
	extension services than men		

	• Women have less access to agricultural information, technology and knowledge
Gender related opportunities	The technology will reduce the time burden for women who mainly fetch water for any activity including irrigation in these ASAL communities
VMG issues and concerns in development, dissemination, adoption and scaling up	 Limited access to credit to purchase the drip irrigation kits than men Limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities Low adoption by VMGs due lack of awareness
VMG related opportunities	Drip technology reduces the workload to the VMGs and provides an opportunity to make business because they are mostly done on high value crops such as tomatoes and vegetables
E: Case studies/profiles of succe	ess stories
Success stories	There are many successful farmer drip irrigation models across the country implemented by government and other development partners. It is noted that linking markets to crops under drip is crucial for sustainability.
Application guidelines for users	 Isaya V. Sijali, 2001. Drip Irrigation: Options for smallholder farmers in eastern and southern Africa. Technical Handbook No. 24. Published by SIDA's Regional Land Management Unit, Nairobi. FAO, 2014. Irrigation Techniques for Small- scale Farmers: Key Practices for DRR Implementers. Rome: Food and Agriculture Organization of the United Nations (FAO). http://www.fao.org/3/a-i3765e.pdf
F: Status of TIMP readiness (1. Ready for up scaling, 2. Requires validation, 3. Requires further research)	3. Ready for up scaling
G: Contacts	
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Lead organization and scientists	KALRO: I. Sijali
Partner organizations and contacts	 Institute Director, KALRO –ICRI Mtwapa Kalro.Mtwapa@kalro.org AMIRAN Kenya, HortiPro, SunCulture, Agro-Irrigation, Aqua-Valley Services Ltd, Davis & Shirtliff

1. The economic impact of drip irrigation on s agriculture in the regions of adoption under study

2. Limited irrigation packages suited to small farmers - improved irrigation, agronomy, credit, technical support and assistance with marketing – to spur adoption

2.7 Cashew Crop Health

2.7.1 Integrated Management of powdery mildew (*Oidium anacardii* F. Noack) disease in cashew

Control of cashew diseases and pests		
TIMP Name	Integrated Management of powdery mildew (<i>Oidium anacardii</i> F. Noack) disease in cashew	
Category (technology, innovation or management practice) A: Description of the technolog	Management practice y, innovation or management practice	
Problem to be addressed	In general, cashew production in Kenya suffers from low productivity due to poor powdery mildew control measures or failure to manage the disease which results in reduction of the economic lifespan of cashew trees	
What is it? (TIMP description)	Integrated management of powdery mildew disease of cashew nut involves the use of a combination of various control measures classified as cultural, biological and chemical control. In order to realize an effective management program for this disease, one has to start with preventive cultural practices and follow up with curative disease control measures i.e. from cultural to chemical control once symptoms are observed. The IPM package is environmentally, economically and human friendly. These management practices start with scouting / monitoring for diseases, their identification and establishment of their incidences and severity which then guide on the control measures to use among the following: Cultural control	
	 Prune trees to avoid overcrowding which creates favorable conditions for the disease Bury infected plant residues 2ft deep to reduce inoculum Field hygiene through disinfection of farm tools with Jik (50ml/1litre water) Avoid overhead irrigation as this will spread the disease through splash 	

	• Spraying with sulphur based fungicides (e.g. Cosavet	
	DF or Devisuipn WP), or Triadimenol based products	
	(e.g Bayndan 250EC) of Anali Top 800 wDG	
Justification	Powdery mildew attacks young panicles and flowers causing crop	
Justification	loss of $70 - 100\%$. Mature trees with potential to produce over 30 kg per tree annually end up producing less than 5 kg annually when infected. Varieties in the Country are susceptible to powdery mildew. The disease causes losses of up to 90\%. Use of the Integrated Management package for controlling powdery mildew in cashew nuts, when applied timely reduces these losses significantly	
B: Assessment of dissemination	and scaling up/out approaches	
Users of TIMP	Cashew growers, Public and private extension service providers	
Approaches used in	Farmer Field and Business School (FFBS)	
Dissemination	Agricultural innovation platforms (AIP)	
	• Demonstrations - On-farm and on station	
	Agricultural shows/exhibitions/field days	
	Trainings - workshops/Seminars/Meetings	
	Public and private Extension Agents	
	• Farmer-to-farmer extension models	
	Mass media - Electronic and print	
	• Publications - posters/brochures/leaflets, manuals	
	 Digital Platforms - Website, Dashboards, Apps, social media short message services 	
Critical/essential factors for successful promotion	 Skilled service providers; availability of appropriate fungicides 	
Partners/stakeholders for scaling up and their roles	 County governments; capacity building, supportive policies and frameworks 	
	• Private sector (AMIRAN); facilitate access to technology;	
	technology demonstration; access to credit	
	• NGOs (Kenya Red Cross- KRC, Action Aid, World Vision,	
	and OXFAM); facilitate access to technology and technology demonstration	
C: Current situation and future scaling up		
Counties where already	Kilifi Kwale Tana River and Lamu	
promoted if any	Kinn, Kwale, Tulu Kiver und Land	
Counties where TIMPs will be up scaled	Lamu	
Challenges in dissemination	Inadequate service providers	
	• Limited expertise in pruning and spraying	
	 Land ownership challenges Limited financial capacity among growers 	
Suggestions for addressing the	Training more experts in pruning and spraving	
challenges	• Encourage more participation of NGOs/private partnerships	
	Resources availed for procurement of motorized sprayers	
	and fungicides	
T 1 1 1 1	• Sensitization and training of agro-chemical dealers.	
Lessons learned in up scaling	• Availability of Cost benefit information enhances adoption	

	Gradual change of cycle of aged trees through copping	
~ • • • • •	and grafting is more effective	
Social, environmental, policy	• The technology requires adequate sensitization since	
and market conditions	disease control in tree crops is not extensively adopted in	
necessary for development and	the Coastal region.	
up scaling	• Care to use environmentally friendly products	
D: Economic gender vulnerab	• There is need to sensitize and regulate agro-chemical dealers	
D. Economic, genuer, vumerab	White the second s	
Basic costs	• Motorized sprayer-KES 60,000 and can cover 1000 trees in a	
	Season Cost of fungicide KES 5000 for fungicides and labor	
Estimated returns	• High returns expected: Vield per tree where disease is	
	uncontrolled is 5kg of cashew nut, which fetches KES 250	
	• Controlled tree gives 30kg of cashew per tree, which	
	fetches KES 2750	
	 Non tangible benefits from trees including environmental 	
	conservation and preserving water catchments	
	• Carbon sequestration, addressing global warming	
	•	
Gender issues and concerns in	• Women and youth have limited access to productive	
development dissemination,	resources such as credit to purchase the required inputs	
adoption and scaling up	such as chemicals than men	
	• Women and youth have limited access to education,	
	training and extension services than men	
	• Women have limited access to markets as they sometimes	
	cannot travel to far markets due to their domestic roles	
	• Women have less access to agricultural information,	
Conder related opportunities	technology and Knowledge	
	Opportunities for youths exists in spraying the crop	
VMG issues and concerns in	• Limited access to credit to buy the required inputs such as	
adoption and scaling up	• Limited access to training and extension services	
adoption and scaning up	 Limited access to markets as they sometimes cannot travel 	
	to far regional markets due to either their sickness	
	disability or lack of exposure	
	• Due to their social status VMGs are often excluded from	
	decision making in development and dissemination	
	activities	
	• Limited access to seed and information on new varieties	
	and production techniques	
	Low adoption by VMGs due lack of awareness	
VMG related opportunities	Opportunities for unemployed youths and those recovering from	
	drugs exists in spraying the crop	
E: Case studies/profiles of success stories		
Success stories from previous	Increased productivity among growers who adopted the practice	
similar projects	in Kilifi, Kwale and Lamu Counties	
Application guidelines for	1. Cashew for Cash booklet, KALRO Mtwapa	
users	2. KALRO Cashew Nut	
	nttps://play.google.com/store/apps/details?id=com.andromo.	

	dev724321.app928007
	3. Cashew Nut Production, A reference handbook for farmers
	in Kenya, F.K. Muniu Kenya
	4. Agricultural and Livestock Research Organization
	(KALRO) P.O. Box 57811-00200, Nairobi, Kenya. Tel:
	+254 (0)204183720 Email: directorgeneral@kalro.org
	Website: www.kalro.org
	5. Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima
	Nchini Kenya, F.K. Muniu Kenya Agricultural and
	Livestock Research Organization (KALRO) S.L.P. 57811-
	00200, Nairobi, Kenya. Simu: +254 020 4183720 Barua
	Pepe: directorgeneral@kalro.org Tovuti: <u>www.kalro.org</u>
F: Status of TIMPs readiness	1. Ready for up scaling
(1. Ready for up scaling, 2.	
Requires validation, 3.	
Requires further research)	
G: Contacts	
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scientists	P.O. Box 16 -80109, Mtwapa
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	Email kalro.mtwapa@kalro.org
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Partner organizations and	Pwani University, info@pu.ac.ke.S. Muti; H. Saha.
contacts	Coast Development Authority, J. Kombe

- 1. Validate efficacy of recommended fungicides in new growing areas (Tharaka Nithi)
- 2. Upscale sensitization, training and regulation of agrochemical dealers for effective service provision

2.7.2 Integrated Management of anthracnose (*Colletotrichum gloesporioides*) disease in cashew

TIMPs Name	Integrated Management of anthracnose (Colletotrichum gloesporioides) disease in cashew
Category (technology, innovation or management practice)	Management practice

	Anthracnose affecting cashew nut
A: Description of the technol	logy, innovation or
management practice	
Problem to be addressed	Losses attributed to anthracnose disease infection which leads to poor quality and yield reduction
What is it? (TIMP	Integrated management of anthracnose disease of cashew nut
description)	involves the use of a combination of various control measures including cultural, biological and chemical control. In order to realize an effective management program for this disease, one has to start with preventive cultural practices and follow up with curative disease control measures i.e. from cultural to chemical control once symptoms are observed. The IPM package is environmentally, economically and human friendly. These management practices start with scouting / monitoring for disease, their identification and establishment of their incidences and severity which then guide on the control measures to use among the following:
	Cultural control
	 Prune trees to avoid overcrowding which creates favorable conditions for the disease Bury infected plant residues 2ft deep to reduce inoculum Field hygiene through disinfection of farm tools with Jik (50ml/1litre water) Avoid injuring plants as this creates avenues for pathogen entry Avoid overhead irrigation as this will spread the disease through splash
	Chemical control
	• Spraying with azoxystrobin based fungicides (e.g Affair Top 800WDG; Amistar Top 325SC), or copper based fungicides (e.g Champflo SC) according to manufacturers' recommendation
Justification	including leaves, nuts and stem/twigs) significantly leading to poor quality of nuts and yields. Use of the Integrated Management package for controlling anthracnose in cashew nuts, when applied timely reduces these losses significantly leading to better quality nuts that fetch more income
B: Assessment of	

dissemination and scaling	
Users of TIMP	 Cashew growers public and private extension service providers Researchers
Approaches used in dissemination Critical/essential factors for successful promotion Partners/stakeholders for scaling up and their roles	 Farmer Field and Business School (FFBS) Agricultural innovation platforms (AIP) Demonstrations - On-farm and on station Agricultural shows/exhibitions/field days Trainings - workshops/Seminars/Meetings Public and private Extension Agents Farmer-to-farmer extension models Mass media - Electronic and print Publications - posters/brochures/leaflets, manuals Digital Platforms - Website, Dashboards, Apps, social media short message services Skilled service providers Availability of appropriate fungicides County governments; capacity building, supportive policies and frameworks Private sector (AMIRAN); facilitate access to technology; technology demonstration; access to credit
C: Current situation and	 NGOs (Kenya Red Cross- KRC, Action Aid, World Vision, and OXFAM); facilitate access to technology and technology demonstration
future scaling up	
promoted if any	Kilifi, Kwale, Tana River and Lamu
Counties where TIMP will be up scaled	Kilifi, Kwale, Tana River and Lamu
Challenges in dissemination	 Inadequate service providers Limited expertise in pruning and spraying Land ownership challenges Limited financial capacity among growers
Suggestions for addressing the challenges	 Training more experts in pruning and spraying Fast-track land registration Encourage more participation of NGOs/private partnerships Resources availed for procurement of motorized sprayers and fungicides Sensitization and training of agro-chemical dealers.
Lessons learned in up scaling	 Availability of cost-benefit information enhances adoption Gradual change of cycle of aged trees through coppicing and grafting is more effective
Social, environmental, policy and market conditions necessary for development and up scaling	 The technology requires adequate sensitization since disease control in tree crops is not extensively adopted in the Coastal region. Care to use environmentally friendly products

	• There is need to sensitize and regulate agro-chemical dealers
D: Economic, gender,	•
vulnerable and marginalized	
groups	
(VMGs) considerations	
Basic costs	• Motorized sprayer-KES 60,000 which can cover 1000
	trees in a season
	• Cost of fungicide 5000 per season depending on severity
	of the disease
Estimated returns	Labor cost @ 5000 per season
Estimated feturits	• High returns expected:
	• Uncontrolled tree-5kg or less of cashew nut, KES 250,
	Controlled tree 30kg of cashew per tree, KES 2/50
	• Intangible benefits from trees:
	o environmental conservation- preserving water
	• Carbon sequestration addressing global warming
Gender issues and concerns in	• Limited ownership and control of land among women
development dissemination	can limit their participation
adoption and scaling up	• Limited access to capital among women can limit
	their participation
	 Bias in training opportunities in favour of men on
	connicing and ton-working
	 Spraying machines are not friendly to women operators
Gander related opportunities	 Spraying machines are not menery to women operators. Tree size is reduced through pruning makes
Gender related opportunities	• The size is feduced through pruning makes
VMG issues and concerns in	Limited access to technical training enportunities among
development dissemination	• Limited access to technical training opportunities among VMC ₂
adoption and scaling up	VINOS
VMG related opportunities	• Tree size is reduced through pruning makes
, interference opportunities	management operations such as spraying pruning
	and harvesting easy for women youth and vulnerable
	persons.
	• Suitable for the youth who become self-employed as
	service providers in spraving and pruning
E: Case studies/profiles of	
success stories	
Success stories from previous	Increased productivity among growers who adopted the
similar projects	practice in
	Kilifi, Kwale and Lamu Counties
Application guidelines for users	1. Cashew for Cash booklet, KALRO Mtwapa
	2. KALRO Cashew Nut
	https://play.google.com/store/apps/details?id=com.androm
	0.000 / 24521.app92800 / 2 Cashay Nut Production A reference handback for formers in
	5. Cashew Nut Production, A reference nandbook for farmers in Konyo, E.K. Muniu Konyo
	A gricultural and Livestock Descende Organization (KALDO)
	P O Box 57811_00200 Nairobi Kanya Tal. ±254
	(0)204183720 Email: directorgeneral@kalro.org Website:

	www.kalro.org
	5. Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima
	Nchini Kenya, F.K. Muniu Kenya Agricultural and Livestock
	Research Organization (KALRO) S.L.P. 57811-00200,
	Nairobi, Kenya. Simu: +254 020 4183720 Barua Pepe:
	directorgeneral@kalro.org Tovuti: www.kalro.org
F: Status of TIMP readiness	1. Ready for up scaling
(1. Ready for up scaling, 2.	
Requires validation, 3. Requires	
further research)	
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G: Contacts Contacts Lead organization and scientists Partner organizations and	G: Contacts Institute Director, KALRO –ICRI Mtwapa Kalro.Mtwapa@kalro.org Box 16-80109, Mtwapa Tel 0202024751 Email; kalro.mtwapa@kalro.org Director.icri@kalro.org KALRO: Mtwapa: F. Muniu, M. Menza, S. Mwashumbe and F. Pole; KALRO: Kabete: Ruth Amata Pwani University, info@pu.ac.ke.S. Muti; H.

- 1. Validate efficacy of recommended fungicides in new growing areas (Tharaka Nithi)
- 2. Upscale sensitization, training and regulation of agrochemical dealers for effective service provision

TIMP Name	Integrated management of	Helopeltis bugs in cashew
Category (technology,	Management practice	
innovation or management		
practice)		
	Damage caused by the bug	Helopeltis bugs in cashew
	Sourc	e: Internet
A: Description of the technology	, innovation or management pra	octice
Problem to be addressed	Control of Cashew and Cotto	on Helopeltis to alleviate leaf
	deformation, dieback, scotched	d appearance, 'witches' bloom
	which result from infestation lead	ling to reduced yields.
What is it? (TIMP description)	Helopeltis bugs, also known as r	nosquito bugs or mirid bugs,
	are the most important pests of c	ashew. These bugs are slender,
	delicate insects, about 7- 10 r	nm long with long legs and
	antennae, the antenna being nea	rly twice as long as the body.

2.7.3 Integrated management of Helopeltis bugs in cashew

	 The females are red and the males' brown to yellowish red. They lay eggs inserted into the soft tissue near the tips of flowering or vegetative shoots. Nymphs (immature bugs) are yellowish in colour. Both adults and nymphs feed on young leaves, young vegetative and flowering shoots, and developing fruits. Control of Helopeltis bugs is through conservation of natural enemies and application of appropriate pesticides. Control Monitor the crop regularly. Helopeltis attack occurs very suddenly and great vigilance is very important to control this pest, particularly during the rainy season or when water is available leading to flushing (production of young shoots) when Helopeltis populations normally build up. Conserve natural enemies. Weaver ants build nests on cashew trees providing good protection against this and other bug pests Do not interplant cashew with crops that are host for <i>Helopeltis</i> bugs, such as cotton, sweet potato, guava and mango.
Justification	The bug is one of the serious cashew pests that can cause damage
	that can lead up to 40% loss. Attacked leaves are deformed and show angular lesions, particularly along the veins, which may drop
	off, so that the leaves appear as if attacked by biting insects.
	Feeding on the stalks of the tender shoots causes elongated green
	lesions, sometimes accompanied by exudation of gum. Severely
	combination with fungi, which enter the plant tissue through the
	feeding lesions; the subsequent development of numerous
	auxiliary buds causes a bunched terminal growth known as 'witches' broom'. In case of serious infestations the trees may
	appear as if scorched by fire. Bug feeding on developing apples
	and nuts causes brown sunken spots. The growth of trees is
	seriously retarded and fruit formation of attacking flowering shoots
B: Assessment of dissemination and scaling un/out approaches	
Users of TIMP	Cashew growers, Public and private extension service providers
Approaches used in	• Farmer Field and Business School (FFBS)
dissemination	Agricultural innovation platforms (AIP)
	Demonstrations - On-farm and on station
	Agricultural shows/exhibitions/field days
	• Trainings - workshops/Seminars/Meetings
	Public and private Extension Agents
	 Farmer-to-farmer extension models Mass media Electronic and print
	 Iviass media - Electronic and print Publications - posters/brochures/leaflets manuals
	 Digital Platforms - Website Dashboards Apps social
	media short message services
Critical/essential factors for	• Skilled service providers; availability of appropriate

successful promotion	pesticides
Partners/stakeholders for	• County governments; capacity building, supportive
scaling up and their roles	policies and frameworks
	• Private sector (AMIRAN); facilitate access to technology;
	technology demonstration; access to credit
	NGOs (Kenya Red Cross- KRC, Action Aid, World
	Vision, and OXFAM); facilitate access to technology and
	technology demonstration
	• Youths – form spraving gangs
C: Current situation and future s	scaling up
Counties where already	Kilifi. Kwale. Tana River and Lamu
promoted if any	,,
Counties where TIMP will be	Kilifi, Kwale, Tana River and Lamu
up scaled	
Challenges in dissemination	Inadequate service providers
	• Inadequate knowledge in managing Helopeltis bug
	• Limited expertise in pruning and spraying
	Land ownership challenges
	Limited financial capacity among growers
Suggestions for addressing the	• Training more experts in pruning and spraying
challenges	• Encourage more participation of NGOs/private partnerships
-	• Link service providers with financial institutions for acquisition
	of inputs
	 Resources availed for procurement of motorized
	sprayers and fungicides
	Sensitization and training of agro-chemical dealers
Lessons learned in up scaling	• Availability of Cost-benefit information enhances adoption
	• Gradual change of cycle of aged trees through
	coppicing and grafting is more effective
Social, environmental, policy	• The technology requires adequate sensitization since Pest
and market conditions	control in tree crops is not extensively adopted in the
necessary for development and	Coastal region.
up scaling	• Care to use environmentally friendly products.
	• There is need to sensitize and regulate agro-chemical dealers.
D: Economic, gender, vulnerabl	e and marginalized groups (VMGs) considerations
Basic costs	Motorized sprayer-KES 60,000 and can cover over 1000 trees
	in a season, Cost of fungicide KES 2500 per litre.
Estimated returns	a) High returns expected:
	Uncontrolled tree-10kg or less of cashew nut, KES 500,
	Controlled tree 30kg of cashew per tree, KES 2750
	b) Intangible benefits from trees:
	1) environmental conservation- preserving water catchments
Condenieques and someores in	n) Carbon sequestration, addressing global warming
development discussion time	• women and yourn have nimited access to productive resources
development dissemination,	such as credit to purchase the required inputs such as chemicals
adoption and scaling up	unan men Wassan and accept have limit have to be the transformed
	• women and youth have limited access to education, training
	and extension services than men
	• women have limited access to markets as they sometimes
	cannot travel to far markets due to their domestic roles

	• Women have less access to agricultural information,
	technology and Knowledge
Gender related opportunities	Opportunities for youths exists in spraying the crop
VMG issues and concerns in	• Limited access to credit to buy the required inputs such as
development, dissemination,	chemicals
adoption and scaling up	• Limited access to training and extension services
	• Limited access to markets as they sometimes cannot travel to
	far regional markets due to either their sickness, disability or
	lack of exposure
	• Due to their social status VMGs are often excluded from
	decision making in development and dissemination activities
	• Limited access to seed and information on new varieties and
	production techniques
	• Low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities for unemployed youths and those recovering from
	chemicals exists in spraying the crop
• E: Case studies/profiles of su	ccess stories
Success stories from previous	Increased productivity among growers who adopted the
similar projects	practice in Kilifi, Kwale and Lamu Counties
Application guidelines for	Leaflets and handouts
users	
F: Status of TIMP readiness	Requires validation
(1. Ready for up scaling, 2.	
Requires validation, 3. Requires	
further research)	
G: Contacts	G: Contacts
Contacts	Institute Director, KALRO –ICRI Mtwapa
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constists	KALKO, MIWAPA: F. MUNIU, M. Menza, S. MWashumbe and F.
Partner organizations and	Pwani University, info@pu.ac.ke.S. Muti; H. Saha.
contacts	Coast Development Authority, J. Kombe

- 1. Validate efficacy of recommended pesticides in new growing areas (Tharaka Nithi)
- 2. Upscale sensitization, training and regulation of agrochemical dealers for effective service provision

2.7.4 Integrated management of Coconut (Coreid)Bug (*Pseudotheraptus wayi*) in cashew

TIMP Name	Integrated management of Coconut (Coreid)Bug (<i>Pseudotheraptus wayi</i>) in cashew
Category (technology,	Management practice
innovation or management	
practice)	

A. Degenintian of the technology	Coconut bug. Source: A.M. Varela, ICIPE
A: Description of the technology,	Control of account bug in order to reduce low production and
rioblem to be addressed	reduced quality resulting from infestation
What is it? (TIMP description)	The coconut bug is an insect of economic importance for cashew
	nuts. Adult bugs are reddish brown in colour and 12 to 14 mm long. Nymphs are red brown to green brown in colour and have long antennae. Bug feeding causes necrotic bruise-like depressions; a hard lump develops, which can be easily removed when the fruit is peeled. The bug sucks on the developing fruits causing pockmarks. The kernels are also affected showing spots, which lower their market value. Control Conserve natural enemies - Weaver ants nest on cashew trees deterring and feeding on coconut bugs.
Justification	The coconut bug is among the most serious coconut pests that can cause major losses. Adult bugs are brown in colour and 1.2 to 1.4 cm long. They lay eggs singly on the flowers or young nuts. Nymphs are red brown to green brown in colour and have long antenna. Adults and nymphs suck on flowers and developing fruits causing flower abortion and early nutfall. The toxic saliva of the bugs causes necrotic sunken lesions (scars) and cracks on the nuts. Attacked
	young nuts excrete gum. Many of the attacked young nuts fall off. Nuts older than 3 months at the time of attack may not be aborted but remain small and have scars. Yield losses are difficult to assess since many of the nuts (over 70%) fall naturally. Nuts which abort naturally, do not show scars or gummosis. Two bugs per palm can cause considerable damage. Damage is usually less serious in

	intercropped coconuts. The bugs also feed on cashew, mango, cocoa	
	and guava. It is therefore important to take the necessary control	
	measures to avoid losses caused by the coconut bug.	
B: Assessment of dissemination	and scaling up/out approaches	
Users of TIMP	Cashew growers, Public and private extension service providers	
Approaches used in	Farmer Field and Business School (FFBS)	
dissemination	• Agricultural innovation platforms (AIP)	
	• Demonstrations - On-farm and on station	
	• Agricultural shows/exhibitions/field days	
	• Trainings - workshops/Seminars/Meetings	
	Public and private Extension Agents	
	• Farmer-to-farmer extension models	
	• Mass media - Electronic and print	
	• Publications - posters/brochures/leaflets_manuals	
	Digital Platforms - Website Dashboards Apps social media	
	short message services	
Critical/essential factors for	Skilled service providers: availability of appropriate pesticides	
successful promotion		
Partners/stakeholders for	• County governments; capacity building, supportive	
scaling up and their roles	policies and frameworks	
	• Private sector (AMIRAN); facilitate access to technology;	
	technology demonstration; access to credit	
	• NGOs (Kenya Red Cross- KRC, Action Aid, World Vision,	
	and OXFAM); facilitate access to technology and technology	
	demonstration	
	• Youths – form spraying gangs	
C: Current situation and future	scaling up	
Counties where already	Kilifi, Kwale, Tana River and Lamu	
promoted if any		
Counties where TIMP will be	Lamu	
up scaled		
Challenges in dissemination	Inadequate service providers	
	• Limited expertise in pruning and spraying	
	• Land ownership challenges	
Second from the state of the	Limited financial capacity among growers	
Suggestions for addressing the	• Training more experts in pesticide application and safety	
challenges	measures	
	• Encourage more participation of NGOs/private partnersmps	
	• Resources availed for procurement of motorized	
	 Sensitization and training of agro chemical dealers 	
Lessons learned in up scaling	 Availability of Cost-benefit information enhances adoption 	
Lessons learned in up searing	 Gradual change of cycle of aged trees through 	
	coppicing and grafting is more effective	
Social, environmental, policy	The technology requires adequate sensitization since pest	
and market conditions	control in tree crops is not extensively adopted in the	
necessary for development and	Coastal region	
up scaling	• Care to use environmentally friendly products	
	• There is need to sensitize and regulate agro-chemical dealers	
---	---	--
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations		
Basic costs	Motorized sprayer-KES 60,000 and can cover over 1000 trees	
	in a season, Cost of fungicide KES 2500 per litre.	
Estimated returns	a) High returns expected:	
	Uncontrolled tree - 10kg or less of cashew nut, KES 500,	
	Controlled tree 30kg of cashew per tree, KES 2750	
	b) Intangible benefits from trees:	
	i) environmental conservation- preserving water catchments	
	ii) Carbon sequestration, addressing global warming	
Gender issues and concerns in	• Limited ownership and control of land among women can	
development dissemination,	limit their participation	
adoption and scaling up	• Limited access to capital among women can limit	
	their participation	
	• Bias in training opportunities in favour of men on coppicing	
	and top-working	
	• Spraying machines are not friendly to women operators.	
Gender related opportunities	• Conservation of natural enemies eases the burden of spraying	
	on women	
	• Training of service providers offers opportunities for youth	
	of both gender	
VMG issues and concerns in	• Limited access to technical training opportunities among	
development, dissemination,	VMGs	
adoption and scaling up		
VMG related opportunities	Suitable for the youth who become self-employed as service	
	providers in spraying and pruning	
E: Case studies/profiles of		
success stories		
Success stories from previous	Increased productivity among growers who adopted the	
Application guidalines for	Leoflete and hendoute	
Application guidennes for		
F. Status of TIMP readiness		
(1 Ready for up scaling 2	2 Requires validation	
Requires validation 3 Requires	2. Requires validation	
further research)		
G: Contacts		
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contacts	Saha. Coast Development Authority, J. Kombe	

- 1. Validate efficacy of recommended pesticides in new growing areas (Tharaka Nithi)
- 2. Upscale sensitization, training and regulation of agrochemical dealers for effective service provision

TIMP Name	Integrated management of Cashew weevil (Mecocorynus
Catagory (tachnology	<i>loripes</i>) in cashew
innovation or management	Management practice
practice)	
	THE REAL AND A
	The second s
	Adult cashew weevil. Source A. M. Varela, ICIPE
A: Description of the technology	y, innovation or management practice
Problem to be addressed	Reduction in yield of cashew nuts that is caused by the tunneling
	and death of plants as a result of infestation by cashew weevil
what is it? (TIMP description)	The cashew weevil is a large insect pest, about 20 mm long, and of
	a knobbed appearance. It is dark grey-brown in colour. The female
	branches. The larvee are leadess grubs, whitish in colour with a
	brown head. They have through the bark and move downwards
	tunneling under the bark while feeding on the sapwood Brown-black
	gummy substance is then seen on the trunk and main branches.
	Heavily attacked trees become ringed by damaged sapwood and
	eventually die. Neglected plantations are likely to be severely
	attacked. Fully-grown larvae pupate in a chamber about 2 cm below
	the bark.
	Control
	• Cut away bark from damaged areas of lightly infested trees and
	kill the larvae and pupae underneath. Repeat this every month for
	a further six months if required.
	• Destroy severely infested trees. First collect and destroy all adult
	weevins, then tell the tree and remove the bark to expose an farvar
	patientes, kin an laivae and pupa and built the tree and conserve
	natural enemies especially weaver and
Justification	Heavy infestation kills the trees and reduces tree population
	and overall production. Control will improve productivity and
	returns to farmers
B: Assessment of dissemination a	and scaling up/out approaches
Users of TIMP	Cashew growers, Public and private extension service providers
Approaches used in	Farmer Field and Business School (FFBS)

2.7.5 Integrated management of Cashew weevil (*Mecocorynus loripes*) in cashew

dissemination	Agricultural innovation platforms (AIP)	
	• Demonstrations - On-farm and on station	
	• Agricultural shows/exhibitions/field days	
	Trainings workshops/Seminars/Meetings	
	Dublic and private Extension A conta	
	Public and private Extension Agents	
	• Farmer-to-farmer extension models	
	Mass media - Electronic and print	
	 Publications - posters/brochures/leaflets, manuals 	
	Digital Platforms - Website, Dashboards, Apps, social media short message services	
Critical/essential factors for	Skilled service providers	
successful promotion		
Partners/stakeholders for	Extension workers, NGOs, private service providers	
scaling up and their roles		
C: Current situation and future scaling up		
Counties where already	Kilifi Kwale Tana River and Lamu	
promoted if any	Kinn, Kwale, Tana Kiver and Land	
Counties where TIMP will be	Lamu	
up scaled		
Challenges in dissemination	Inadequate service providers	
	• Limited expertise in debarking and removal of insect	
	growth stages lodged beneath	
	Land ownership challenges	
	Limited financial capacity among growers	
Suggestions for addressing the	• Training more experts in control measures	
challenges	• Encourage more participation of NGOs/private partnerships	
	Fast-track land registration	
· · · · ·	Resources availed for procurement of debarking equipment	
Lessons learned in up scaling	Availability of Cost-benefit information enhances adoption	
Social, environmental, policy	• The technology requires adequate sensitization since pest	
and market conditions	control in tree crops is not extensively adopted in the	
necessary for development	Coastal region	
and up scaling	• Care to use environmentally friendly products	
	• There is need to sensitize and regulate agro-chemical	
	dealers	
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations		
Basic costs	Debarking and felling of severely infested trees can cost upto	
	KES	
	1,000.00	
Estimated returns	a) High returns expected:	
	Uncontrolled tree-10kg or less of cashew nut, KES 500,	
	Controlled tree 30kg of cashew per tree, KES 2750	
	b) Intangible benefits from trees:	
	1) environmental conservation- preserving water catchments	
Condeniesues and senseries in	n) Carbon sequestration, addressing global warming	
development discomination	• women and yourn have minited access to productive resources	
adoption and application,	such as credit to purchase the required inputs such as chemicals	
adoption and scaling up	than men	

	• Women and youth have limited access to education, training
	and extension services than men
	• women have limited access to markets as they sometimes
	cannot travel to far markets due to their domestic roles
	• Women have less access to agricultural information,
	technology and knowledge
Gender related opportunities	Opportunities for youths exists in spraying the crop
VMG issues and concerns in development, dissemination,	• Limited access to credit to buy the required inputs such as chemicals
adoption and scaling up	• Limited access to training and extension services
	• Limited access to markets as they sometimes cannot travel to
	far regional markets due to either their sickness, disability or
	lack of exposure
	• Due to their social status VMGs are often excluded from
	decision making in development and dissemination activities
	• Limited access to seed and information on new varieties and
	production techniques
	• Low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities for unemployed youths and those recovering from
	chemicals exists in spraying the crop
E: Case studies/profiles of succes	s stories
Success stories from previous	Increased productivity among growers who adopted the
similar projects	practice in Kilifi, Kwale and Lamu Counties
Application guidelines for	Leaflets and handouts
users	
F: Status of TIMP readiness	2. Requiress validation
(1. Ready for up scaling, 2.	
Requires validation, 3. Requires	
further research)	
G: Contacts	
Contacts	Institute Director, KALRO–ICRI Mtwapa Kalro.Mtwapa@kalro.org
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Partner organizations and	Pwani University, info@pu.ac.ke.S. Muti; H.
contacts	Saha. Coast Development Authority, J. Kombe

- 1. Validate efficacy of appropriate pesticides in new growing areas (Tharaka Nithi)
- 2. Upscale sensitization, training and regulation of agrochemical dealers for effective service provision

2.7.6	Integrated management of Ro	ed banded thrips	s (Selenothri	ps rubrocinctus)
		· · · · · · · · · · · · · · · ·		

TIMP Name	Integrated management of Red banded thrips (Selenothrips rubrocinctus)
Category (technology, innovation or management	Management practice
practice)	

	Red banded thrips (Selenothrips rubrocinctus) Source: A.M. Varela, ICIPE
A: Description of the technology	y, innovation or management practice
Problem to be addressed	Control of the Red banded thrips to reduce dropping off of infested
What is it? (TIMP description)	Ieaves, flowers and shoots, poor fruit formation and low production Adults of the red banded thrips are dark brown or blackish. Nymphs are pale yellow with a broad transverse red band on the dorsal side of the abdomen. Thrips attack older leaves, flowers and shoots. Attacked
	Infestation of flowers causes poor fruit formation. Severe infestations may cause considerable damage. Control
	The red band thrips can be effectively controlled through conservation of natural enemies. Anthocorid bugs are important in natural control of the thrips. Application of appropriate pesticides is also one of the control measures.
Justification	The red band thrips are serious pests of cashew. Their infestation may reduce raw nut production of upto 30%. The kernel weight of the nuts can also be reduced by about 50%, thereby resulting into low yields and low returns.
B: Assessment of dissemination	and scaling up/out approaches
Users of TIMP	Cashew growers, Public and private extension service providers
Approaches used in	Farmer Field and Business School (FFBS)
dissemination	Agricultural innovation platforms (AIP)
	• Demonstrations - On-farm and on station
	Agricultural shows/exhibitions/field days
	Trainings - workshops/Seminars/Meetings
	Public and private Extension Agents
	• Farmer-to-farmer extension models
	Mass media - Electronic and print
	Publications - posters/brochures/leaflets, manuals
	• Digital Platforms - Website, Dashboards, Apps, social media short message services
Critical/essential factors for	• Skilled service providers; availability of appropriate
successful promotion	fungicides

Partners/stakeholders for	County governments; capacity building, supportive
scaling up and their roles	policies and frameworks
	• Private sector (AMIRAN); facilitate access to technology;
	technology demonstration; access to credit
	• NGOs (Kenya Red Cross- KRC, Action Aid, World Vision,
	and OXFAM); facilitate access to technology and
	technology demonstration
	Youths – form spraying gangs
C: Current situation and future	scaling up
Counties where already	Kilifi, Kwale, Tana River and Lamu
promoted if any	
Counties where TIMP will be	Kilifi, Kwale, Tana River and Lamu
up scaled	
Challenges in dissemination	Inadequate service providers
	• Limited expertise in pest management
	• Land ownership challenges
Suggestions for addressing the	Limited financial capacity among growers
suggestions for addressing the	• Training more experts in natural enemies conservation and
chanenges	use Training on offective and sefe application of posticides
	• Training on effective and safe application of pesticides
	• Encourage more participation of NGOs/private partnersmps
	Resources availed for procurement of motorized
	sprayers and pesticides
Lassons loornad in up scaling	• Sensitization and training of agro-chemical dealers
Lessons learned in up scaling	 Availability of Cost benefit information enhances adoption Gradual change in use of pesticides
Social environmental policy	The technology requires adequate sensitization since pest
and market conditions	control in tree crops is not extensively adopted in the
necessary for development and	Coastal region
un scaling	Care to use environmentally friendly products
up searing	• There is need to sensitize and regulate agro-chemical dealers.
D: Economic, gender, vulnerabl	e and marginalized groups (VMGs) considerations
Basic costs	Motorized sprayer - KES 60,000 and can cover 1000 trees in a
	season,
	Cost of pesticide approximately KES 2500 per litre.
Estimated returns	High returns expected: Uncontrolled tree-5kg of cashew nut, KES
	250 Controlled tree 30kg of cashew per tree, KES 2750
	b) Intangible benefits from trees: i) environmental conservation-
	preserving water catchments
	ii) Carbon sequestration, addressing global warming
Gender issues and concerns in	• Women and youth have limited access to productive
development dissemination,	resources such as credit to purchase the required inputs such
adoption and scaling up	as chemicals than men
	• Women and youth have limited access to education, training
	and extension services than men
	• Women have limited access to markets as they sometimes
	cannot travel to far markets due to their domestic roles
	• Women have less access to agricultural information,
	technology and Knowledge

Gender related opportunities	• Opportunities for youths exists in spraying the crop
VMG issues and concerns in development, dissemination, adoption and scaling up	 Limited access to credit to buy the required inputs such as chemicals Limited access to training and extension services Limited access to markets as they sometimes cannot travel to far regional markets due to either their sickness, disability or lack of exposure Due to their social status VMGs are often excluded from decision making in development and dissemination activities Limited access to seed and information on new varieties and production techniques Low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunities for unemployed youths and those recovering from
	drugs exists in spraying the crop
E: Case studies/profiles of	E: Case studies/profiles of success stories
success stories	
Success stories from previous	Increased productivity among growers who adopted the
similar projects	practice in
	Kilifi, Kwale and Lamu Counties
Application guidelines for	Leaflets and handouts
users	
F: Status of TIMP readiness	2. Requires validation
G: Contacts	
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- Validate efficacy of appropriate pesticides in new growing areas (Tharaka Nithi)
 Upscale sensitization, training and regulation of agrochemical dealers for effective service provision

2.7.7 Integrated management of Mealybugs (<i>Pseudococcus longispinus</i>)	
TIMP Name	Integrated management of Mealybugs (Pseudococcus longispinus)
Category (technology, innovation or management practice)	Management practice

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	Mealybugs on leaf. Source: A.M. Varela, ICIPE
A: Description of the technolog	gy, innovation or management practice
Problem to be addressed	Control of mealybugs for reducing fruiting failure due to infestation and discoloration of nuts which result in lower nut grades that fetch low prices in the market
What is it? (TIMP description)	The body of the adult female is 2 - 3.6 mm long, soft, elongate oval and somewhat flattened. The long-tailed mealybug (<i>Pseudococcus</i> <i>longispinus</i>) attacks shoots, inflorescences, apples and nuts. Affected parts appear completely white. Trees infested during the flowering stage fail to produce fruits, whereas those infested at the nut swelling stage produce discolored nuts, which result in a lower grade. However, cutting tests showed no difference in kernel outturn between clean and discolored nuts. Mealybugs have been a problem for cashew growers in Kenya as well as the neighboring Tanzania.
	Conserve natural enemies - Mealybugs are usually controlled by a wide range of natural enemies. However, use of pesticides may kill these natural enemies leading to mealybug outbreaks.
Justification	Mealybugs are among the most serious pests of greenhouse plants. Infested plants look unsightly because of the whitish cottony mass of insects and the black sooty mold fungus that develops on honeydew excretions. Mealybugs are present in the greenhouse throughout the year. The presence of ants should alert the grower to check ant trails to determine if ants are carrying mealybugs into the greenhouse. Pesticide spraying appears to be the most economical way to control mealybugs. However, the waxy coating of the mealybug makes it difficult for pesticide sprays to penetrate and kill the insect. Repeated spray applications may be necessary.
	of their tendency to hide in protected locations (e.g., undersides of leaves or in bracts) and form dense colonies, making contact difficult. The waxy coverings also protect them from being wetted by chemical sprays. Infestation results in fruiting failure, nut discoloration and lowering of the grade. It is therefore an economic important pest that poses a threat to cashew production and all efforts geared towards controlling it should be put in place.
B: Assessment of dissemination	and scaling up/out approaches
Users of TIMP	Cashew growers, public and private extension service providers

Approaches used in	Farmer Field and Business School (FFBS)
dissemination	• Agricultural innovation platforms (AIP)
	• Demonstrations - On-farm and on station
	• Agricultural shows/exhibitions/field days
	 Trainings - workshops/Seminars/Meetings
	Dublic and private Extension A conta
	• Public and private Extension Agents
	Farmer-to-farmer extension models
	• Mass media - Electronic and print
	• Publications - posters/brochures/leaflets, manuals
	• Digital Platforms - Website, Dashboards, Apps, social media
	short message services
Critical/essential factors for successful promotion	Skilled service providers; availability of appropriate fungicides
Partners/stakeholders for	• County governments; capacity building, supportive
scaling up and their roles	policies and frameworks
	• Private sector (AMIRAN); facilitate access to technology;
	technology demonstration; access to credit
	• NGOs (Kenya Red Cross- KRC, Action Aid, World Vision,
	and OXFAM); facilitate access to technology and
	technology demonstration
	• Youths – form spraying gangs
C: Current situation and future s	scaling up
Counties where already	Kilifi, Kwale, Tana River and Lamu
Counties where TIMP will be	Kilifi Kwala Tana Piyor and Lamu
up scaled	Kinni, Kwale, Talia Kiver and Laniu
Challenges in dissemination	Inadequate service providers
	• Inadequate knowledge in managing Mealybugs
	• Limited Expertise in pruning and spraying
	Land ownership challenges
	Limited financial capacity among growers
Suggestions for addressing the	• Training more experts in pruning and spraying
challenges	• Encourage more participation of NGOs/private partnerships
	• Link service providers with financial institutions for acquisition
	• Resources availed for procurement of motorized sprayers
	and fungicides
	 Sensitization and training of agro-chemical dealers
Lessons learned in up scaling	Availability of Cost-benefit information enhances adoption
	Gradual change in use of pesticides
Social, environmental, policy	• The technology requires adequate sensitization since pest
and market conditions	control in tree crops is not extensively adopted in the Coastal
necessary for development and	region
up scaling	• Care to use environmentally friendly products.
	• There is need to sensitize and regulate agro-chemical dealers.
D: Economic, gender,	D: Economic, gender, vulnerable and marginalized groups
vulnerable and marginalized	(VMGs) considerations
groups	

(VMGs) considerations	
Basic costs	Motorized sprayer-KES 60,000 and can cover 1000 trees in a
	season, Cost of pesticide approximately 2500 per litre.
Estimated returns	High returns expected: Uncontrolled tree-15kg of cashew nut,
	KES 750
	Controlled tree 30kg of cashew per tree, KES 2750
	b) Intangible benefits from trees: i) environmental conservation-
	preserving water catchments
	11) Carbon sequestration, addressing global warming
Gender issues and concerns in	• Limited ownership and control of land among women can
development dissemination,	limit their participation
adoption and scaling up	• Limited access to capital among women can limit
	their participation
	• Bias in training opportunities in favour of men on coppicing
	and top-working
	• Spraying machines are not friendly to women operators.
Gender related opportunities	Introduction of natural enemies (Weaver ants) makes pest
	management by use of pesticides less necessary allowing women to
	engage in other activities
VMG issues and concerns in	• Limited access to credit to buy the required inputs such as
development, dissemination,	chemicals
adoption and scaling up	• Limited access to training and extension services
	• Limited access to markets as they sometimes cannot travel to
	far regional markets due to either their sickness, disability or
	lack of exposure
	• Due to their social status VMGs are often excluded from
	decision making in development and dissemination activities
	• Limited access to seed and information on new varieties
	and production techniques
	Low adoption by VMGs due lack of awareness
VMG related opportunities	Conservation of natural enemies makes pest management
	operations such as spraying less demanding for women, youth
	and vulnerable persons.
	• Suitable for the youth who become self-employed as
	service providers in pest management
E: Case studies/profiles of	E: Case studies/profiles of success stories
success stories	
Success stories from previous	Increased productivity among growers who adopted the practice
similar projects	in Kilifi, Kwale and Lamu Counties
Application guidelines for	Leaflets and handouts
Users	2 Deservices and identical
(1 Poody for upscaling: 2	2. Requires validation
Requires validation: 3 Requires	
further research)	
G: Contacts	
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scientists	Pole
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Contacts	

- 1. Validate efficacy of appropriate pesticides in new growing areas (Tharaka Nithi)
- 2. Upscale sensitization, training and regulation of agrochemical dealers for effective service provision

2.7.8 Integrated management of Cashew stem girdler (*Paranaleptes reticulata*)

TIMP Name	Integrated management of Cashew stem girdler (Paranaleptes
	reticulata)
Category (technology,	Management practice
innovation or management	
practice)	Cashew stem girdler (<i>Paranaleptes reticulata</i>)
	Source: A M Varela ICIPE
A: Description of the technology, i	innovation or management practice
Problem to be addressed	Control of the Cashew stem girdler to reduce damage of cashew
	trees.
What is it? (TIMP description)	Adult stem girdlers are a long horn beetles, with a body length of 25-35 mm and with antennae longer that the body. The head and the thorax are dark brown; the wing cases are orange with large black blotches giving them a reticulate appearance. The Adult beetles girdle branches from 3-8 mm in diameter leaving a V-section cut; only a narrow, central pillar round the pith zone is left, which eventually breaks off. Female beetles lay elongated eggs in transverse slits made in the bark of the girdled branch at points above the girdle. Larvae are yellow, in colour and reaches a length of 45 mm when fully grown. They mine in dead wood of the girdled branches. Pupation takes place in the dead wood. The lifecycle takes one year. This beetle is a common but usually minor pest of cashew in the Coast Province of Kenya.
	• Once a year (in November or December) collect and burn all girdled branches. Only the dead or dying part of the branch
	above the girdle needs to be collected and burnt
Justification	The Cashew stem girdler are pests of cashew. However, neglected
	plantations may be severely damaged leading to death of cashew

	trees.
B: Assessment of dissemination ar	nd scaling up/out approaches
Users of TIMP	Cashew growers, Public and private extension service providers
Approaches used in	Farmer Field and Business School (FFBS)
dissemination	Agricultural innovation platforms (AIP)
	• Demonstrations - On-farm and on station
	• Agricultural shows/exhibitions/field days
	• Trainings - workshops/Seminars/Meetings
	Public and private Extension Agents
	• Farmer-to-farmer extension models
	• Mass media - Electronic and print
	• Publications - posters/brochures/leaflets, manuals
	• Digital Platforms - Website, Dashboards, Apps, social media
	short message services
Critical/essential factors for	• Skilled service providers; availability of appropriate
successful promotion	fungicides
Partners/stakeholders for scaling	• County governments; capacity building, supportive
up and their roles	policies and frameworks
	• Private sector (AMIRAN); facilitate access to technology;
	technology demonstration; access to credit
	• NGUS (Kenya Red Cross- KRC, Action Aid, World
	vision, and OXFAM); facilitate access to technology and technology demonstration
	 Youths – form spraying gangs
C: Current situation and future	scaling up
Counties where already	Kilifi, Kwale, Tana River and Lamu
promoted if any	
Counties where TIMP will be up	Kilifi, Kwale, Tana River and Lamu
scaled	
Challenges in dissemination	 Inadequate service providers Limited expertise in past management
	 Limited expertise in pest management L and ownership challenges
	 Limited financial capacity among growers
Suggestions for addressing the	• Training more experts in natural enemies conservation and
challenges	use
	• Training on effective and safe application of pesticides
	• Encourage more participation of NGOs/private partnerships
	Resources availed for procurement of motorized
	sprayers and pesticides
Lassons learned in up scaling	 Sensitization and training of agro-chemical dealers. Availability of Cost banefit information enhances adoption
Lessons learned in up scaling	 Gradual change in use of pesticides
Social, environmental, policy	• The technology requires adequate sensitization since pest
and market conditions necessary	control in tree crops is not extensively adopted in the
for development and up scaling	Coastal region
	• Care to use environmentally friendly products.
	• There is need to sensitize and regulate agro-chemical
	dealers.

D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations		
Basic costs	Motorized sprayer-KES 60,000 and can cover 1000 trees in a	
	season,	
	Cost of pesticide approximately 2500 per litre.	
Estimated returns	High returns expected: Uncontrolled tree-5kg of cashew nut, KES	
	250 Controlled tree 30kg of cashew per tree, KES 2750	
	b) Intangible benefits from trees: i) environmental conservation-	
	preserving water catchments	
	11) Carbon sequestration, addressing global warming	
Gender issues and concerns in	• Women and youth have limited access to productive	
development dissemination,	resources such as credit to purchase the required inputs such	
adoption and scaling up	as chemicals than men	
	• Women and youth have limited access to education, training	
	and extension services than men	
	• Women have limited access to markets as they sometimes	
	cannot travel to far markets due to their domestic roles	
	• Women have less access to agricultural information,	
Conden valated and articles	technology and Knowledge	
Gender related opportunities	• Opportunities for youths exists in spraying the crop	
VMG issues and concerns in	• Limited access to credit to buy the required inputs such as	
development, dissemination,	chemicals	
adoption and scaling up	• Limited access to training and extension services	
	• Limited access to markets as they sometimes cannot travel	
	to far regional markets due to either their sickness, disability	
	or lack of exposure	
	• Due to their social status VMGs are often excluded from	
	decision making in development and dissemination activities	
	• Limited access to seed and information on new varieties	
	and production techniques	
VMC seleted as a strandition	Low adoption by VMGs due lack of awareness	
v MG related opportunities	druge exists in encoving the eren	
F. Case studies/profiles of	E: Cose studios/profiles of success stories	
success stories	E. Case studies/promes of success stories	
Success stories from previous	Increased productivity among growers who adopted the	
similar projects	practice in	
	Kilifi, Kwale and Lamu Counties	
Application guidelines for users	Leaflets and handouts	
F: Status of TIMP readiness (1.	2. Requires validation	
Ready for upscaling; 2. Requires		
validation; 3. Requires further		
research)		
G: Contacts		
Contacts	Institute Director, KALRO –ICRI Mtwapa Kalro.Mtwapa@kalro.org	
Lead organization and scientists	KALRO, Mtwapa: F. Muniu, M. Menza, S. Mwashumbe and F.	
	Pole	
Partner organizations and	Pwani University, info@pu.ac.ke.S. Muti; H. Saha.	
contacts	Coast Development Authority, J. Kombe	

- 1. Validate efficacy of appropriate pesticides in new growing areas (Tharaka Nithi)
- 2. Upscale sensitization, training and regulation of agrochemical dealers for effective service provision

TIMP Name	Integrated Weed Management	t
Crop management practices	Management practices	
A: Description of the technology, inr	novation or management practic	ce
Problem addressed	Weeds pose a major challed Significant yield losses in cashed poor weed management. Weed moisture and space with the crop an environment conducive for co loss of quantity and quality of nu weeds in cashew production inco grass, star grass and annual we soldier, Mexican marigold and we require various strategies for	enge in cashew production. ew production are attributed to ds compete for nutrients, soil p, harbor insect pests and create lisease occurrence. They cause its at harvest. Some of the major lude grass weeds such as couch eds such as black jack, gallant vandering jew. Different weeds effective control, hence the
	advantage of combining the var	ious management strategies.
	Wandering Jew (Commelina Benghalensis L.)	Double thorn (<i>Oxygonum sinu</i> (Meisn.) Dammer associating foot (<i>dactylocteniumaegyptiu</i> <i>Ragwort</i> (<i>Seneciodiscifolia</i> Olatum Withcrows m) and iv.)
	Gallant soldier (<i>Galinsoga</i>	Blackjack (<i>Bidens pilosa</i> L.)

2.7.9 Integrated Weed Management

Digitaria veluntina (Forssk.)P. Beauv.	Wild finger millet (<i>Eleusine</i> Gaertn.) <i>Indica</i> (L.)
Purslane (<i>Portulca oleraceae</i> L)	Lateweed (Trichode smazeyla Among grassweeds nicum)
Coatweed	Sowthistle (Sonchusolerace us
(Ageratumconyzoides L.)	L.)
Terere (Amaranthus graecisans)	Oxalis (<i>Oxalis latifoli</i>) H.B.

Chickweed (Stellaria media (L.)) Vill.	Wildlettuce (Launaea cornuta (Hochst. Ex Oliv. & Hiern))
Parthenium (Parthenium hysterophorus)	Thornapple (<i>Datura stramoniun</i> L.)
Asthmaweed (<i>Euphobia hirta</i>	Wildraddish (Raphanus raphanistrum)
Starbur (<i>Acanthospermum</i> <i>hispidum</i> DC.)	Eshaaga (<i>Eracustrum</i> <i>arabicum</i> Fisch. & C.A. Mey.)

	Chinese Lantern (<i>Nicadra physaloides</i>)	Tarvine (Boerhavia diffusa L.)
	Steud.)	abyssinica)
What is it? (TIMP description)	Integrated weed management (weeds using several weed app physical control, biological co- mulch, cultural, mechanical and Physical control is the remov- mechanical means, such as ha- manual weeding farmers carry of weed free fields after planting Biological control is where you g control is where appropriate h weeds. Cultural control includes the intercrops since various crop and abundance of particular w management includes use of farm weeder, which does the work m Chemical weed management in elective herbicides and or post-e	IWM) is the management of proaches such as preventive, ontrol, use of biodegradable chemical control. val of weeds by manual or and weeding or mowing. In out manual weeding and keep g and just before flowering. graze by big animals. Chemical erbicides are used to control the practice of crop rotation of os may influence the diversity weed flora. Mechanical weed in equipment such as motorized such faster and is less tedious. volves use of pre-emergences mergence selective herbicides.
Justification	They cause loss of quantity ar Majority of farmers in Kenya us management. Whereas this is e and labour intensive. Whereas r can also be ineffective when wee because all weeds are apparently becomes a big problem. Weeds a approach will be effective on Therefore you need more than under control. Judicious use herbicides could be an effective cashew. Post emergence is ap actively growing weeds for effective control of weeds at germination	ad quality of nuts at harvest. e manual approaches for weed ffective, it is time consuming manual weeding is effective it eding is done in wet conditions replanted. Therefore regrowth re so diverse and therefore one some species and not others. one approach to keep weeds of pre- and post-emergence ve time and labour saving in plied to control existing and ctive control. Pre-emergence is stage or as they emerge from

	the soil. Herbicides are classified basing on their mode of application, time of application, action (contact or systematic). Contact herbicides kill the part covered and is best for annual weeds. Systemic are absorbedby the leaves or roots and then translocated through the plant system to the point of action.		
	selective will kill all. It is important to confirm the registered		
	herbicides (Pesticide Control Board Manual) that can be used		
	by Cashew growers.		
B:Assessment of dissemination and s	scaling up/out approaches		
Users of TIMP	Farmers, Extension workers, Agrodealers		
dissemination	• Farmer Field and Business School (FFBS)		
	Agricultural innovation platforms (AIP)		
	• Demonstrations - On-farm and on station		
	• Agricultural shows/exhibitions/field days		
	• Trainings - workshops/Seminars/Meetings		
	• Public and private Extension Agents		
	• Farmer-to-farmer extension models		
	Mass media - Electronic and print		
	• Publications - posters/brochures/leaflets, manuals		
Critical/essential factors promotion	 Promote integrated weed management (IPM) Address environmental and safety concerns related to the use of herbicides Accompany the promotion with demos and field days with farmer groups and stakeholders on the effectiveness of the various weed management options using FFSB approach. Train users on appropriate use of herbicide and safe use Train people on biology of weeds and weed dynamics in cropping systems. Farmers need training on timing with regard to conservation of biodiversity Preserve pollinators for 		
	increased productivity.		
Partners/stakeholders for scaling up	Agrochemical companies, Research partners		
and their respective roles.	(KALRO,CIAT),County extension staffs, NGOs		
Counties where	ng up Kilifi		
Already promoted if any			
Counties where TIMPs will be up	Kilifi, Kwale, Lamu,		
scaled			
Challenges in development and	High cost of herbicides		
dissemination	• Inadequate knowledge and information on which		
	herbicides to use and when to use them.		
	Myths on appropriateness of using herbicides		
Suggestion for addressing the challenges	Avail attordable credits and recover from proceeds of farmers' produce		
	 Promotion of the product by conducting demos and 		
	field days and involvement of the stakeholders		

	including agro-chemical companies
	• Develop and disseminate information to various
	stakeholders Training on integrated approaches using
	available methods
	• Including appropriate herbicides and their use
Lesson learned in up scaling, if any	• That integrated approaches of weed management are
	more effective than use of one control method. It is safe
	and environmentally friendly.
	• Continuos use of herbicide has environmental, health
	and social hazards.
Social, environmental, policy and	 Build capacity on an IWM approach/ practice
market conditions necessary for	• Have an environmental and safety plan when using
development and up- scaling	herbicides
	• Address the environmental and social concerns related
	to use of agrochemicals.
	• A functional agrodealer network to supply the products
	when required by the farmers
D:Economic,gender,vulnerable and	marginalized groups(VMGs) considerations
Basic costs	KES 4 000 per acre
Estimated returns	KES 30,000 per acre
Gender issues and concerns in	Since weeding for cashews is mostly done by women and
Development and	children, dissemination strategies should target women more
dissemination	but also take care of men to become aware of the TIMP.
Gender issues and concerns in	• Make all gender understand the benefits of IWM.
adoption and scaling up	• Empower both men and women to make a judicious
	decision on IWM approach.
	• Use of IWM technology can reduce drudgery due to
	manual weeding and save time for other activities to
Conder related opportunities	Volliell
Gender related opportunities	Labour is reduced therefore opportunities exist for women and
	youth to get in other economic activities including the
Vulnerable and marginalized groups	VMC groups could be limited in accessing the knowledge
(VMC) issues and sonesma in	vivio groups could be infinited in accessing the knowledge
(VING) issues and concerns in	lend diamites
development, dissemination,	land disputes.
Adoption and scaling up	
VMG related opportunities	I raining VMG on IWM practices and opportunities
E. Case studies/promes of success su	
Application	Extension and training material available
Guidelines for users	
F. Status of TIMP Readiness (1	1 Ready for up scaling
Ready for unscaling: 2 Requires	1. Ready for up scaling
validation: 3 Requires further	
research)	
G:Contacts	
Contacts	1. Center Director KALRO
	Kabete
	P. OBox14733-00800. Nairobi
	2. Institute Director, KALRO–ICRI Mtwapa.

	kalro.mtwapa@kalro.org
Lead organization and scientists	KALRO Kabete: H.Mwangi, V. Momanyi
Partner organizations and contacts	NGOs, CBOs, County Governments, KEPHIS

• Determine cost benefits of using motorized weeder versus other weed management strategies in cashew production

TIMP Name	Cover cropping for cashewnut weed management
Categories (technology innovation or management	Innovation
practice)	• • •
A:Description of the technolog	y, innovation or management practice
Problem addressed	Weed competition in cashew monocropping system is a big problem that leads to reduced yield.
What is it? (TIMP description)	Innovative Legume Intercropping Systems are the application of growing more than one crop in a field at the same time, as a tool to enhance agricultural production and to obtain efficient land use. Intercropping systems are defined based on the temporal and spatial arrangements of the crops. There are several intercropping systems such as mixed, strip, row intercropping patterns, Relay and Alley intercropping. In cashew, cowpea has been used as a cover crop in young orchards at a spacing of 90 cm x 60 cm between the cashew plants There are several intercropping Cover cropping With cowpea in Cashewnut Source:
Justification	Cover cropping with appropriate variety of cover crop (technology) works well with cashew. Large amounts of cover crop foliage will reduce weed emergence by forming a physical barrier. Cover crops may also be left to conserve soil moisture and modify soil temperatures where necessary as an added benefit. Cover cropping supports bio-diversity and is compatible with the principles of

2.7.10	Cover	cropping f	or	cashew	nut	weed	managemen	t
		** * P P 8 -						

	balanced agriculture.
B: Assessment of dissemination	and scaling up/out approaches
Users of TIMP	Farmers, Extension Staff
Approaches used in dissemination	 Farmer Field and Business School (FFBS) Agricultural innovation platforms (AIP) Demonstrations - On-farm and on station Agricultural shows/exhibitions/field days Trainings - workshops/Seminars/Meetings Public and private Extension Agents
	 Farmer-to-farmer extension regents Farmer-to-farmer extension models Mass media - Electronic and print Publications - posters/brochures/leaflets, manuals Digital Platforms - Website, Dashboards, Apps, social media short message services
Critical/essential factors for	Conduct demos, field days with farmers groups and stakeholders
Partners/stakeholders for scaling up and their respective roles. C:Current situation and future Counties where already promoted, if any Counties whitetips will be upscaled	 KALRO – Research & capacity building Universities - Research & technical backstopping Kenya Plant Health Inspectorate Services (KEPHIS) - Seed inspection CBOs, NGOs - Seedlings multiplication and technology dissemination seed company Nursery operators - Seedlings multiplication Extension workers - Dissemination and technical backstopping scaling up Kilifi Lamu, Kilifi, Kwale
Challenges in development	Inadequate training and limited extension staff
Suggestion for addressing the challenges Lesson learned in up scaling if any	 Facilitation of training of county extension staffs Conduct demos and field days Intercropping systems are knowledge intensive and require making adjustments in traditional ways of cropping. Such a change calls for intensive training and demonstration for farmers to familiarize with the technology and its benefits. There is need to adapt the technology and promote it in new environments/AEZ
Social, environmental, policy and market conditions necessary for development and up-scaling	A farmer learning platform is essential for training on how to deploy the cover crop technology for weed management.

D:Economic, gender, vulnerab	le and marginalized groups (VMGs) considerations
Basic costs	- KES 5,000 per acre
Estimated returns	- KES 30,000 per acre
Gender issues and concerns in development, dissemination adoption and scaling up	 Complexity of the intercropping system can result in increased labour, which could impact on the women who are key players during planting and weeding Women have less access to information, technology and knowledge Women and youth have limited access to the equipment used to make the water pan than men Women have less access to land that can be used for water pan than men Women and youth have limited access to education, training and extension services than men Men dominate most decisions at the household and Community levels
Gender related opportunities	• Intercropping offers good opportunities to both men and women to grow diverse crops for economic gains and at the same time offers enhanced biodiversity benefits
VMG issues and concerns in development, dissemination, adoption and scaling up	 Less access to agricultural information, technology and knowledge Limited access to productive resources such as land, credit, and quality seed Limited access to training and extension services Due to their social status VMGs are often excluded from decision making in development and dissemination activities Low adoption by VMGs due lack of awareness
VMG related opportunities	Intercropping places emphasis on the importance of using available land space to grow diverse of food crops leading to, increase biodiversity, pest management thus the practice is economically viable for the VMGs
E: Case studies/profiles of succ	ess stories
Success stories	MBILI-MBILI system working in Bungoma, Kakamega, Siaya, Trans Nzoia and Uasin Gishu
Application guidelines for users	Extension and training material available
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research) G: Contacts	2. Requires validation
Contacts	Center Director KALRO Kabete, Waiyaki Way, P.O Box14733-
Lead organization and scientists	KALRO Kabete: H. Mwangi, V. Momanyi.
Partner organizations and contacts	County Extension Staff, Farmer Groups and CBOs, NGOs

TIMP name	Mulching for weed control in cashew orchards
Category (technology,	Technology
innovation or management	
A: Description of the technology	v. innovation or management practice
Problem addressed	Weeds infestation soil moisture and loss of organic matter, in
	ASAL.
What is it? (TIMP description)	The practice of covering the soil/ground with natural or synthetic materials. Mulches can effectively control weeds from seeds that germinate near or at the soil surface. There are two types of mulches: biodegradable or natural mulches. Biodegradable include straw, dead leaves and compost to make more favourable conditions for plant growth, development and efficient crop production. The mulches should be between 2 - 4 inches deep to be effective. Nondegradable or synthetic mulches can be used in growing of climbing beans. Only black mulches should be used to control weeds.
	Benefits: Organic mulches retain moisture in the soil; suppress weeds; keep the soil cool; and help improve soil fertility (as the mulches decompose) and improves microclimate hence increasing biodiversity. Synthetic mulches will solarize soils, control weeds and weed seeds, retains oil moisture and controls diseases.
	1.Mulching using dry grass2. Plastic mulch(source;www.jains.com)(source; F.K. Muniu)
Justification	Organic mulching has added benefits other than minimizing weeds infestation; it facilitates retention of soil moisture and helps to control temperature fluctuations, improves physical, chemical and biological properties of soil, adds nutrients to the soil and ultimately enhances the growth and yield of crops. It also improves soil structure directly by preventing raindrop impact and indirectly by promoting biological activity. Synthetic mulch are easy to obtain and

2.7.11 Mulching for weed control in cashew orchards

	apply, and are reusable.
B:Assessment of dissemination a	and scaling up/out approaches
Users of TIMP	Farmers
Approaches to be used in	• Farmer Field and Business School (FFBS)
dissemination	• Agricultural innovation platforms (AIP)
	• Demonstrations - On-farm and on station
	Agricultural shows/exhibitions/field days
	• Trainings - workshops/Seminars/Meetings
	Public and private Extension Agents
	• Farmer-to-farmer extension models
	Mass media - Electronic and print
	• Publications - posters/brochures/leaflets, manuals
	• Digital Platforms - Website, Dashboards, Apps, social media
	short message services
Critical/essential factors for	• Availability of plant or crop residues for organic mulches
successful promotion	must take care not to introduce new weed seeds or disseminate
	weed seeds.
	• Size of the land.
	Competing uses of crop residues.
	• -Type of the crops/Synthetic
	material
	Cost of materials
	Disposal of synthetic material after use
Partners/stakeholders for	 KALRO – Research & capacity building
scaling up and their roles	Universities - Research & technical backstopping
	• Kenya Plant Health Inspectorate Services (KEPHIS) - Seed
	inspection
	• CBOs, NGOs - Seedlings multiplication and technology
	dissemination
	• seed company
	• Nursery operators - Seedlings multiplication
	• Extension workers - Dissemination and technical
	backstopping
C: Current situation and future	scaling up
Counties where already	Not used in cashew in Kenya. Used to some extent in Thailand
promoted	
Counties where TIMP will be	Lamu
promoted	
Challenges in dissemination	• Lack of enough plant and crop residues due to competing uses
	in organic mulches
	• Possibilities of insect build up categorized as pest or disease
	vectors or weed seeds in organic mulches
Suggestions for addressing the	• Crop diversification to increase availability of organic mulches.
challenges	• Establish and follow a good integrated pest control
	management program for the particular beans.
	• Adapting alternative mulching materials like high absorbance
	polymers
Lessons learned	• There is need to adapt to alternative mulching technologies in
	addition to use of organic materials like crop, plant residues
Social, environmental, policy	Practice is socially acceptable
· · · · · · · · · · · · · · · · · · ·	

and market conditions	Environmentally friendly
necessary	• Increased productivity will provide supply to the markets
	• Supporting frameworks/policies are available
D: Economic, gender, vulnerabl	e and marginalized groups (VMGs) considerations
Basic costs	Organic mulch is low cost but labour intensive during the initial
	application.
Estimated returns	Dependent on value chain but generally >100% of the initial
	investments assuming other factors are in control.
Gender issues and concerns in	• Since the activity is labour intensive it may increase the labour
development, dissemination,	burden for the various gender categories
adoption and scaling up	• The TIMP will reduce women's weeding time that can be used
	to perform other productive activities
Gender related opportunities	• The TIMP can offer employment for the youths.
VMG issues and concerns in	• Though easy to use, it is be a bit labour intensive for VMGs,
development, dissemination,	hence its adoption and scaling up may be slow
adoption and scaling up	
VMG related opportunities	• Mulch is locally available on-farm, and thus has very cheap
	• Low cost implying that all including VMGs can take advantage
	of the practice.
E: Case studies/profiles of succe	ss stories
Success stories	Farmers in different value chains have reported improved soil
	conditions, reduced runoff and nutrient loss, soil moisture retention
	in the soil and generally increased crop production following
	application of mulching technology.
Application guidelines for users	Leaflets and handouts
F :Status of TIMP readiness (1.	1. Ready for up scaling
Ready for upscaling; 2. Requires	
validation; 3. Requires further	
research)	
G:Contacts	
Contacts	Centre Director KALRO Kabete, off Waiyaki way,
	P.O. Box 14733-00800, NAIROBI. <u>Tel: +254-</u>
	$\frac{0721822312}{100}$
T 1 · <i>i</i> · · · · · · · · · · · · · · · · · · ·	E-mail:cd.narl@kalro.org
Lead organization and scientists	KALKU: H. Mwangi, V. Momanyi.
Partner organizations and	County governments
Contacts	Public-Private-Partnerships

 Determine cost benefits of using biological live mulch/dead crop residues versus plastic mulch in cashew production systems.

TIMP Name	Chemical Weed Control in cashew orchards
Category (technology,	Technology
innovation or management	
practice)	
A: Description of the technology	ogy, innovation or management practice
Problem addressed	Heavy weed infestation in beans fields
What is it? (TIMP description)	Chemical weed control refers to any technique that involves the
	application of herbicide to weeds or soil to control the growth or

2.7.12 Chemical Weed Control in cashew orchards

	germination of the weed species. Herbicide weed control is a
	technology that requires knowledge on herbicides registered for
	cashew (PCPB Manual, 2020).
Justification	Manual hand weeding is very labour intensive, scarce and expensive.
	Use of herbicides reduces drudgery and effects can be a timely weed
	control option.
B:Assessment of dissemination	n and scaling up/out approaches
Users of TIMP	Farmers and extension agencies
Approaches used in	• Farmer Field and Business School (FFBS)
dissemination	Agricultural innovation platforms (AIP)
	• Demonstrations - On-farm and on station
	Agricultural shows/exhibitions/field days
	Trainings - workshops/Seminars/Meetings
	Public and private Extension Agents
	• Farmer-to-farmer extension models
	Mass media - Electronic and print
	• Publications - posters/brochures/leaflets, manuals
	 Digital Platforms - Website, Dashboards, Apps, social media short message services
Critical/essential factors for	 Capacity building and training on safe use of chemicals for all
successful promotion	users
Partners/stakeholders for	• Public and private partners –[MOALD) for extension,
scaling up and their respective	Chemical companies for backstopping
roles	 ICRISAT for technical backstopping and promotion
	• FIPs (Farmer Input Promotion) for promotion
	• Farmer Groups for activity implementation and promotion
	• Service provider agencies including Micro-finance agencies and
	banks for credit provision, agro-vets for input supply.
	• Processors and manufacturers to create market for produce,
	aggregators including CARD (Community Action for Rural
	Development) for economy of scale sales and marketing0, and
	others including NGOs, CBOs, and FBOs to provide specialist
	services like community mobilization, nutrition training among
	others.
C: Current situation and futu	ire scaling up
Counties where already	Herbicide weed control can be upscaled in all the areas where cashew
promoted	are being grown.
Counties where TIMP will be	Herbicide weed control can be upscaled in all the areas where cashew
Upscaled	are being grown.
Challenges in dissemination	• Limited knowledge and information and low literacy levels
	United and application requires knowledge and training
	• Include use and application requires knowledge and training on safe of herbicides
	The farmers need to understand the proper use and application
	of herbicides to avoid buying the wrong herbicides
Recommendations for	Train the agricultural extension county officers as TOTs on safe
addressin	use of herbicides. This help in reaching the farmers with the
auuressiii auuressiii	information
5 uic	information.

challenges	• Herbicides like all chemicals have to be used with care to avoid
	environmental and social hazards.
	• Liaise with the Agricultural extension and environmental
	officers on the ground for Guidance on safe use of chemicals
Lessons learned	Access to and use of information on different methods of weed control
	will reduce drudgery and cost of weed management. It could give room
	to increase are under
	Cultivation and increase productivity.
Social, environmental, policy	Sensitization of communities on alternative methods of weed control
and market conditions	and safe use of chemicals is very necessary.
necessary	
D: Economic, gender, vulner	able and marginalized groups (VMGs) considerations
Basic costs	Herbicide use is cheaper than manual weed
	Control because it requires less labour.
Estimated returns	Not yet estimated
Gender issues and concerns in	Need to sensitize both men and women on
development and	Value of crop losses caused by weed competition
dissemination	
Gender issues and concerns in	Women and children are the main sources of labour for cashew.
development, dissemination	Adoption of technology will reduce the labour burden on women and
concerns in adoption and	children. The children can get time for school work, while the women
scaling up	can engage in other Economic activities
seaming up	eun engage in outer Deonomie aeuvries
Gender related opportunities	Women stand to benefit in increased production due to timely
	operations, increased yields
VMG issues and concerns in	Due to prejudice associated with their social status. VMGs are
development and	excluded from access to and benefits from improved technologies
dissemination	Thus affirmative action is required to promote the crop for the VMGs
VMG issues and concerns in	Timely operations will lead to enhanced production by VMGs
adoption and scaling up	Timery operations will lead to enhanced production by vivies.
VMG related opportunities	Increased production will lead to increased consumption of cashew
I I I I I I I I I I I I I I I I I I I	which is high in proteins hence improved health of VMGs; high value
	of crop will lead to economic empowerment of VMGs
	of erop will foud to economic empowerment of vives
E: Case studies/profiles of su	ccess stories
Success stories	
Application guidelines for	Weed control leaflets/manuals
E Status of TIMD Doodings	1 Deady for up cooling
(1 Deady for upgedling: 2	1. Ready for up scaling
(1. Ready for upscaling, 2.	
Requires valuation, 5.	
C:Contects	
Contacts	KAIRO
Lead organization and	KALRO: H. Mwangi, V. Momanyi
scientists	
Partner organizations and	ICRISAT Nairobi; MoALD in Counties, Chemical companies
contacts	

GAPS:

• Determine cost benefits of using synthetic chemicals versus other weed management strategies in cashew nut production

TIMP Name	Mechanical weeding in cashew		
Category (technology,	Technology		
innovation or management			
practice)			
	and the second sec		
	Motorized weeder		
	(Source: cnsprayers.en.madeinchina.com)		
A:Description of the technology	, innovation or management practice		
Problem addressed	Weeds in cashew cropping system. Weeds around the tree trunks		
	give severe competition for water and nutrients with the cashew.		
What is it? (TIMP description)	This is motorized weeding using a weeder implement to maintain		
	weed free transplanted clean certified hardened cashew nut		
	seedlings growing in well prepared ground with deep well drained		
	sandy soils of pH 4.2 - 8.7.		
	Planting should be done in rows at 10m x 10m to facilitate inter-		
	Tow weeding. Row Weeders (Manual/motorized) are implements used to weed		
	hetween the rows. The intra-row weeds are removed by hand		
	nulling		
Justification	Weeds if not controlled cause yield losses due to competition.		
	habour, attract other pests (insects and diseases) and can adulterate		
	the quality of the cashew produce.		
B:Assessment of dissemination a	and scaling up/out approaches		
Users of TIMP	Farmers and Agricultural extension officers		
Approaches to be used in	• Farmer Field and Business School (FFBS)		
dissemination	Agricultural innovation platforms (AIP)		
	• Demonstrations - On-farm and on station		
	Agricultural shows/exhibitions/field days		
	• Trainings - workshops/Seminars/Meetings		
	Public and private Extension Agents		
	• Farmer-to-farmer extension models		
	Mass media - Electronic and print		
	• Publications - posters/brochures/leaflets, manuals		
	• Digital Platforms - Website, Dashboards, Apps, social media		
	short message services		
Critical/essential factors for	• Participatory implementation, stakenoider sensitization.		
Partners/stakeholders for scaling	• Public and private partners –[MOALD) for extension,		
up and their respective roles	Jua Kali artisans		
	• Processors and manufacturers to create market for produce,		
	aggregators including CARD (Community Action for Rural		

2.7.13 Mechanical weeding in cashew

	Development) for economy of scale sales and marketing),
	and others including NGOs, CBOs, and FBOs to provide
	specialist services like community mobilization, nutrition
	training among others
C:Current situation and future	scaling up
Counties where promoted	All counties where cashew is grown
Counties where TIMP will be upscaled	All counties growing cashew.
Challenges in dissemination	Implements not readily available in the market.
Recommendations for addressing	Work with Jua Kali industries for fabrication of appropriate implements
the challenges	 Facilitate local manufacture of such machineries by international investors to accelerate transfer of technology to Jua Kali industries
Lessons learned	Access and use of technologies will provide
	timely weed control which will enhance crop production
Social environmental policy and	Sensitization of communities on the available
market conditions necessary	technologies and management practices in weed management
D: Economic, gender, vulnerable	e and marginalized groups (VMGs) considerations
Basic costs	Basic cost of the weeder (implement is high at KES 28 000 for
Basic costs	ordinally bean farmers, they can purchase as a group.
Estimated returns	Not yet estimated
Gender issues and	Need to sensitize both men and women on value of crop losses
concernsin	caused by weed competition
development and dissemination	
Gender issues and concerns in	Women and children are the main sources of labour for this crop.
development, dissemination	Adoption of technology will reduce the labour burden on women
concerns in adoption and scaling	and children. The children can get time for school work, while the
up	women can engage in other economic activities
Gender related opportunities	Women stand to benefit in increased production due to timely
	operations, increased yields. Women perform most of the crop production activities such as weeding hence the TIMP may reduce their work burden.
VMG issues and concerns in	Due to prejudice associated with their social status, VMGs are
development and dissemination	excluded from access to benefits from improved technologies. Thus,
_	affirmative action is required to promote the crop for the VMGs
	including value addition aspects
VMG issues and concerns in	Timely operations will lead to enhanced production by VMGs.
adoption and scaling up	
VMG related opportunities	Increased production will lead to increased consumption of cashew
	which is high in proteins hence improved health of VMGs; high
	value of crop will lead to economic empowerment of VMGs
E: Case studies/profiles of succe	ss stories
Success stories	Not yet accessible to cashew farmers
Application guidelines for users	Leaflets and manuals
F: Status of TIMP Readiness (1.	1. Ready for up scaling
Ready for up scaling, 2. Requires	

validation, 3. Requires further	
G: Contacts	
Contacts	KALRO
Lead organization and scientists	KALRO: H. Mwangi, V. Momanyi.
Partner organizations and contacts	ICRISAT Nairobi; MoALD, Counties

- 1. Determine cost-benefits of using mechanical weeding tools such as motorized weeder versus other weed management strategies in cashew nut production.
- 2. Power weeder is heavy so not friendly to women users. Research on gender sensitive weeders.

2.6.14 TIMP Name	Safe Use of Agrochemicals (Herbicides)
Category (technology,	Management practice
practice)	
A: Description of the technology, innovation or management practice	
Problem addressed	Excessive pesticide application to crops, use of pesticides for spraying crops without wearing the right protective clothing, storage of pesticides in non-designated stores, wrong application techniques, spraying at the wrong times and against the wind direction, use of pesticides without following the guidelines provided on the labels. Inadequate enforcement of global policies
What is it? (TIMP description)	Capacity building of farmers, crop protection teams on safe handling and use of pesticides right from transportation from the agro-dealers to storage in their houses, mixing procedures and their application in the field in order to ensure safety of the crop, the person handling them and the environment at large. The technology will include proper methodologies for proper pesticide disposal to minimize pollution of the environment.
Justification	There have been incidences of excessive use and improper handling that lead to the spray operators inhaling the chemicals in the process of spraying. Use of inappropriate spray equipment lead to leakages thereby exposing the operators to health risks as well as contamination of the water bodies. Most of these irregularities can easily be corrected through sensitization and capacity building forums for end users to be made aware of the best practices that should be used when handling pesticides.

2.7.14 Safe Use of Agrochemicals (Herbicides)

	Full protection when spraying cashew
	Source: Stella Katini
B:Assessment of dissemination	on and scaling up/out approaches
Users of TIMP	Cashew farmers, Agrodealers, Spray service providers
Approaches used in	• Farmer Field and Business School (FFBS)
dissemination	Agricultural innovation platforms (AIP)
	• Demonstrations - On-farm and on station
	Agricultural shows/exhibitions/field days
	• Trainings - workshops/Seminars/Meetings
	Public and private Extension Agents
	• Farmer-to-farmer extension models
	Mass media - Electronic and print
	Publications - posters/brochures/leaflets, manuals
	Digital Platforms - Website, Dashboards, Apps, social media short message services
Critical/essential factors for	Collaboration between all partners, willingness of farmers to adhere to
successful promotion	proper guidelines, adequate facilitation: funds, logistics (transport)
Partners/stakeholders for scaling up and their roles	• Ministry of Agriculture Extension Service providers at County level to conduct extension services and farmer trainings
	• Individual Farmers farmer groups/CBOs to participate in the
	implementation of the various technologies for cashewnut
	production
	• KALRO, CABI, AAK, PCPB, KEPHIS and Universities to
C. Current situation and fut	develop the technologies and conduct ToTs,
Counting where to shup lo guin	It's scaling up
already being promoted if	KIIII
Any	
Counties where TIMPS will be up scaled	Kilifi
Challenges in dissemination	• Change of mindset in favour of current practices maybe difficult to achieve
	• Illiteracy and inadequate capacity to use pesticides correctly. Most farmers cannot read and interpret the labels properly

	resulting to overuse or underuse of pesticides
	• Use of banned pesticides from neighboring countries
	• Inadequate capacity by farmers and agrochemical companies to
	dispose pesticides properly
Suggestions for addressing the	• Capacity building and sensitization forums for both farmers and
challenges	agro dealers using participatory approach
	• Formation of youth spray teams
	Establishment of aggregation/incineration centres for used negation centres for used
	Establishment of training of Extension staff and load formers as
	• Establishment of training of Extension start and lead farmers as
	• Increase surveillance along the border points and enforce the
	laws
Lessons learned in upscaling	Upscaling of this technology needs young educated men and youth due
if any	to its hazardous nature. Some of the aspects of this technology need a
5	lot of capital to actualize. For instance, the collection and incineration
	of pesticide containers needs a lot of money that may not be accessible
	by most men or youth groups. The high illiteracy levels of majority
	farmers may hinder the use of correct information/ knowledge in the
	use of pesticides in some areas.
Social, environmental, policy	Organized collective marketing channels critical for benefits to be
and market conditions	derived from practice
D: Economic. gender. vulner	able and marginalized groups (VMGs) considerations
Basic costs	KES 5 000 per acre
Estimated returns	KES 35 000 per acre
Gender issues and concerns	• Technology is not safe for use by expectant women and the
in development	physically challenged individuals because of it hazardous/dangerous
dissemination, adoption and	nature
scaling up	• Women have less access to credit to buy inputs such as pesticides
	band protective gears
	• Women have less access to knowledge and information on the
	dangers of chemicals especially on storage and disposal
	• Low levels of literacy and inability to read and interpret the content
	of the pesticides labels especially on re-entry period after spraying.
	of the pesticides labels especially on re-entry period after spraying. This cause pesticides poisoning to men and women who spray and
	of the pesticides labels especially on re-entry period after spraying. This cause pesticides poisoning to men and women who spray and harvest
Gender related opportunities	 of the pesticides labels especially on re-entry period after spraying. This cause pesticides poisoning to men and women who spray and harvest Employment opportunities for youths exist in the following areas: Offering apray calibration services to formers as an enterprise
Gender related opportunities	 of the pesticides labels especially on re-entry period after spraying. This cause pesticides poisoning to men and women who spray and harvest Employment opportunities for youths exist in the following areas: ✓ Offering spray calibration services to farmers as an enterprise ✓ Surveillance/scouting to help farmers in pest and disease
Gender related opportunities	 of the pesticides labels especially on re-entry period after spraying. This cause pesticides poisoning to men and women who spray and harvest Employment opportunities for youths exist in the following areas: ✓ Offering spray calibration services to farmers as an enterprise ✓ Surveillance/scouting to help farmers in pest and disease diagnostic services
Gender related opportunities	 of the pesticides labels especially on re-entry period after spraying. This cause pesticides poisoning to men and women who spray and harvest Employment opportunities for youths exist in the following areas: ✓ Offering spray calibration services to farmers as an enterprise ✓ Surveillance/scouting to help farmers in pest and disease diagnostic services ✓ Collection of pesticide containers and assist in the incineration
Gender related opportunities	 of the pesticides labels especially on re-entry period after spraying. This cause pesticides poisoning to men and women who spray and harvest Employment opportunities for youths exist in the following areas: ✓ Offering spray calibration services to farmers as an enterprise ✓ Surveillance/scouting to help farmers in pest and disease diagnostic services ✓ Collection of pesticide containers and assist in the incineration processes by AAK
Gender related opportunities	 of the pesticides labels especially on re-entry period after spraying. This cause pesticides poisoning to men and women who spray and harvest Employment opportunities for youths exist in the following areas: Offering spray calibration services to farmers as an enterprise Surveillance/scouting to help farmers in pest and disease diagnostic services Collection of pesticide containers and assist in the incineration processes by AAK Owning and operating agro chemicals that stock right pesticides and
Gender related opportunities	 of the pesticides labels especially on re-entry period after spraying. This cause pesticides poisoning to men and women who spray and harvest Employment opportunities for youths exist in the following areas: ✓ Offering spray calibration services to farmers as an enterprise ✓ Surveillance/scouting to help farmers in pest and disease diagnostic services ✓ Collection of pesticide containers and assist in the incineration processes by AAK Owning and operating agro chemicals that stock right pesticides and offer pest and disease advisory services to farmers at the agro vet
Gender related opportunities	 of the pesticides labels especially on re-entry period after spraying. This cause pesticides poisoning to men and women who spray and harvest Employment opportunities for youths exist in the following areas: Offering spray calibration services to farmers as an enterprise Surveillance/scouting to help farmers in pest and disease diagnostic services Collection of pesticide containers and assist in the incineration processes by AAK Owning and operating agro chemicals that stock right pesticides and offer pest and disease advisory services to farmers at the agro vet shops
Gender related opportunities	 of the pesticides labels especially on re-entry period after spraying. This cause pesticides poisoning to men and women who spray and harvest Employment opportunities for youths exist in the following areas: ✓ Offering spray calibration services to farmers as an enterprise ✓ Surveillance/scouting to help farmers in pest and disease diagnostic services ✓ Collection of pesticide containers and assist in the incineration processes by AAK Owning and operating agro chemicals that stock right pesticides and offer pest and disease advisory services to farmers at the agro vet shops These are dangerous products that may not be handled by
Gender related opportunities VMG issues and concerns in development,	 of the pesticides labels especially on re-entry period after spraying. This cause pesticides poisoning to men and women who spray and harvest Employment opportunities for youths exist in the following areas: Offering spray calibration services to farmers as an enterprise Surveillance/scouting to help farmers in pest and disease diagnostic services Collection of pesticide containers and assist in the incineration processes by AAK Owning and operating agro chemicals that stock right pesticides and offer pest and disease advisory services to farmers at the agro vet shops These are dangerous products that may not be handled by vulnerable groups

scaling up	groups that may not utilize them
VMG related opportunities	 Unemployed youths have opportunities in the following areas: ✓ Offering spray calibration services to farmers as an enterprise ✓ Surveillance/scouting to help farmers in pest and disease diagnostic services ✓ Collection of pesticide containers and assist in the incineration processes by AAK Owning and operating agro chemicals that stock right pesticides and offer pest and disease advisory services to farmers at the agrovet shops. Youths to offer spray calibration services to farmers as an enterprise
E: Case studies/promes of su	
Success stories	 The AAK has trained youth spraying teams that have helped in the spraying of the farms in a few counties thus reducing cases of people being exposed to pesticides There are reported cases of farmers who regularly scout their crop that have reported to using less pesticides on their farm Some counties who have aggregation centres by AAK for collection of pesticide containers. This has led to reduction of these containers on farms Safe use of Pesticide campaigns by AAK, PCPB KALRO and MoALD have resulted in safer use of pesticides.
Application guidelines for users	Brochures developed by KALRO and CABI as reference material
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research) G: Contacts	2. Requires validation
Contacts	Contro Director VALDO Kobata
Lead organization and Scientists	KALRO: H. Mwangi, V. Momanyi
Partner organizations and contacts	MoALD, CABI, PCPB, AAK, KEPHIS, County Governments and Universities

2.8 Harvesting and Postharvest Management

2.8.1 Timely harvesting and handling of cashew nuts

TIMP Name	Timely harvesting and handling of cashew nuts
Category (technology, innovation or management	Management Practice
practice)	
A: Description of the technology, innovation or management practice	
Problem to be addressed	Loss of nuts quality
What is it? (TIMP description)	
	It is the process of collecting the fallen fruits and separating the apple

	from the finit. To get good quality nuts, clear the area honesth the tree
	from the fruit. To get good quality nuts, clear the area beneath the tree
	to facilitate the picking of the fruits; collect fallen fruits, and detach the
	nut from the apples, and put them in a basket or sack. Nuts should be
	picked off the cleared ground daily. Harvesting can be done manually
	or by machines.
	Manual harvesting of matured cashew nuts at the Kenyan coast (Source: Stella, KALRO-Mtwapa)
Justification	Delay in harvesting of cashew nuts results in losses caused by
	mycotoxin, insects, moisture and, animals. Leaving the nuts
	uncollected lowers the quality (kernel becomes yellowish and higher
	in oil).
B: Assessment of dissemination	and scaling up/out approaches
Users of TIMP	Farmers, agripreneurs, extension staff, traders, processors and
Ammoocheevedin	researchers
Approaches used in dissemination	• Use of on-farm demos, exhibition during field days, farmer to former training and agricultural shows
dissemination	• Mass madia (TV and radio programs promotional materials
	leaflets posters brochures manuals and pamphlets)
	• Use of digital platforms comprising web materials mobile
	telephone applications and short message services (SMS)
	Regular localized meetings
	• Farmer field and business Schools (FFBS)
	Agricultural Innovation Platforms (AIP)
	• Public and private agricultural extension services.
Critical/essential factors for	• Willingness of farmers to learn
successful promotion	• Extension support
	Organized Farm labour
Partners/stakeholders for scaling	• Agricultural Extension service-To conduct farmer sensitization, on-
up and their roles	farm and on station demonstrations
	• Farmers- To take attend the training and implement it
	• Processors and traders- Buy the enhanced cashew nut produce
	• Researchers – Work with farmers to implement improved
	 NGOs dealing with cashew Dissemination of the practices
C: Current situation and futur	e scaling up
Counties where already	Kilifi, Kwale, Tana River, Lamu
promoted if any	,,, _ where the transmission of the second se

Counties where TIMP will be up scaled	Kilifi, Kwale, Tana River, Lamu
Challenges in dissemination	Lack of knowledge on appropriate harvesting technology.
	Perceived as time consuming.
Suggestions for addressing the	• Awareness creation about the technology to farmers and
challenges	traders
	• Capacity building of farmers on appropriate harvesting
	Introduction of machinery for harvesting
Lessons learned in up scaling if	• Loss of quality can be minimized through timely harvesting and
any	handling of cashew nuts
Social, environmental, policy	• Awareness creation of advantages timely harvesting to all
and market conditions necessary	social groups
for development and up scaling	• Include all gender groups when sharing research and validation
	findings.
	• Create awareness on effect of moisture on loss of quality.
D: Economic, gender, vulneral	ole and marginalized groups (VMGs) considerations
Basic costs	To yet determined
Estimated returns	Reduced losses, better income and nutrition (due to utilization of
	saved nut)
Gender issues and concerns in	• In the target county, cashew is mainly cultivated by women, hence
development, dissemination,	these should be targeted
adoption and scaling up	• The TIMP is easily adoptable after training and many farmers can
	use the technology since it reduces losses incurred during and
	after harvesting.
Gender related opportunities	The TIMP increases farm income through reduction of harvest losses.
	Women can capitalize on this aspect of cashew production to reduce
	harvest losses
VMG issues and concerns in	Manual harvesting can be practised by energetic women and youth.
development, dissemination,	Mechanical harvesting can be encouraged to all gender, including the
VMC related opportunities	VIMUS.
V MO related opportunities	Adoption of the Thirrs means feduced losses, hence more cashew huts
	enough cashew put to consume hence get macro- and micro-putrients
	(especially minerals). There will be more income for the farmers
	(VMGs).
E: Case studies/profiles of succ	ess stories
Success stories from previous	Clean cashew kernels and of good grades fetch good prices in areas
similar projects	where timely harvesting was done
Application guidelines for users	1. Cashew planting guide, KALRO Mtwapa
rr oor	2. Cashew for Cash booklet, KALRO Mtwapa
	3. KALRO Cashew Nut
	https://play.google.com/store/apps/details?id=com.andromo.de
	<u>v724321.app928007</u>
	4. Cashew Nut Production, A reference handbook for farmers in
	Kenya, F.K. Muniu Website: <u>www.kalro.org</u>
	5. Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima Nchini
	Kenya, Muniu F.K.
F: Status of TIMP readiness	Require validation
(1-ready for upscaling; 2-	
----------------------------------	---
requires validation; 3-requires	
further research)	
G: Contacts	
Contacts	
Lead organization and scientists	KALRO: Wayua F., Ndambuki J.
Partner organizations and	Agricultural University Colleges, MoALD, NGOs, CBOs
contacts	

- 1. Validating maturity indices of the various cashew varieties
- 2. Quantification of the losses due to incorrect timing of the right maturity for harvesting different Cashew varieties
- 3. Quantification of losses of cashew apple occurring during harvesting.

TIMP Name	Cashew grading recommendations	
Category (technology, innovation or management practice)	Management Practice	
A: Description of the tech	nology, innovation or management practice	
Problem to be addressed	Low prices of produce due to mixed and unsorted nuts	
What is it? (TIMP description)	This the separation of nuts based on size, colour, shape and moisture content and assigning a grade to the respective categories. Each of the categories may be assigned a value based on it comparative quality or grade.	
Instification	Currently no grading of raw nuts is taking place. Nuts of different	
Justification	qualities are sold at the same price leading to low average buying	
	prices. Grading allows categories of comparative higher quality valued	
	highly compared those of lower quality. Diseased nuts are picked	
	discarded to avoid destroying others in storage.	
B: Assessment of dissemination and scaling up/out approaches		
Users of TIMP	Cashew growers, agripreneurs, public and private extension service providers, cashew nut buyers, cashew processors.	
Approaches used in	• Use of on-farm demos, exhibition during field days, farmer to farmer	
dissemination	training and agricultural shows	
	• Mass media (TV and radio programs, promotional materials leaflets, posters, brochures, manuals and pamphlets)	

2.8.2 Cashew grading recommendations

	• Use of digital platforms comprising web materials, mobile telephone
	applications and short message services (SMS)
	 Regular localized meetings
	 Regular localized incentings Farmer field and business Schools (EEDS)
	Family field and busiless Schools (FFBS)
	• Agricultural innovation Platforms (AIP)
	• Public and private agricultural extension services.
Critical/essential factors for	• Farmers willingness to learn and take up new ideas
successful promotion	• Public and private extension service to provide training
	• Farmers, traders and processors willing to adopt the grading system
	• Development and implementation of cashew grading regulations by
	the County government.
Partners/stakeholders for	Public and private extension Workers-Dissemination and technical
scaling up and their	backstopping
respective roles.	 Non-governmental organizations-Upscaling and financing
	• Processor, traders and farmers - Adopt and implement the
	grading system
	• County government- Oversee the grading regulations
C: Current situation and f	uture scaling up and financing
Counties where already	Kilifi, Kwale, Tana River and Lamu
promoted. if any	
Counties where TIMPs will be upscaled	Kilifi, Kwale, Tana River and Lamu
Challenges in development	• Lack of willingness by buying agents to adopt grading as a
and dissemination	criterion for buying nuts
Suggestions for addressing	• Training farmers and players in the value chain
the challenges	• Provision of physical infrastructure for grading (collection
	centers)
	Strengthening farmer organizations
	• Encourage more participation of NGOs/private partnerships in
	promoting grading in procuring raw nuts
	Instituting regulations on cashew nut grading
Lessons learned in up scaling, if any	• Yet to be implemented
Social. environmental.	The technology is socially acceptable and environmentally friendly
policy and market	because it involves sale of nuts based on grade. Will give better prices
conditions necessary for	for those taking care of their trees and producing high quality
development and up-	nuts
scaling	
D: Economic, gender, vuln	erable and marginalized groups (VMGs) considerations
Basic costs	Minimal costs in grading
Estimated returns	To do
Gender issues and	• Women and youth have limited access to credit to purchase the
concerns in development,	roasting equipment
dissemination, adoption and	• Women and youth have limited access to education training
scaling up	and extension services than men
	 Men dominate decisions on cashew at the household
	and community
Gender related	 Employment opportunities exist for women in cashew puts
Sender renued	- Employment opportunities exist for women in cashe whites

VMG issues and concerns in development, dissemination, adoption and scaling up VMGs have limited access to credit to purchase the roasting equipment VMGs have limited access to education, training and extension services There is low adoption by VMGs due lack of awareness VMG related opportunities Employment opportunities exist for VMGs in cashew nut grading Excase studies/profiles of success stories Profitability was higher when the cashew nut processing factory was operational in Kilifi and nuts were purchased based on grades Application guidelines for users Cashew planting guide, KALRO Mtwapa Cashew for Cash booklet, KALRO Mtwapa KALRO Cashew Nut https://play.google.com/store/apps/details?id=com.andromo.dev72 4321.app928007 Cashew Nut Production, A reference handbook for farmers in Kenya, F.K. Muniu Website: www.kalro.org Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima Nchini Kenya, F.K. Muniu Predimess (1. Ready for up scaling; 2. Requires further research)	opportunities	processing
 in development, dissemination, adoption and scaling up VMGs have limited access to education, training and extension services There is low adoption by VMGs due lack of awareness Employment opportunities exist for VMGs in cashew nut grading E: Case studies/profiles of success stories Success stories Profitability was higher when the cashew nut processing factory was operational in Kilifi and nuts were purchased based on grades Application guidelines for users Cashew for Cash booklet, KALRO Mtwapa Cashew for Cash booklet, KALRO Mtwapa KALRO Cashew Nut https://play.google.com/store/apps/details?id=com.andromo.dev72 4321.app028007 Cashew Nut Production, A reference handbook for farmers in Kenya, F.K. Muniu Website: www.kalro.org Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima Nchini Kenya, F.K. Muniu F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research) Gontacts Contacts Institute Director, KALRO –ICRI Mtwapa Kalro.Mtwapa@kalro.org KALRO Mtwapa: Muniu F., Mwashumbe S and Menza M. scientists 	VMG issues and concerns	• VMGs have limited access to credit to purchase the roasting
dissemination, adoption and scaling up • VMGs have limited access to education, training and extension services VMG related opportunities • There is low adoption by VMGs due lack of awareness VMG related opportunities • Employment opportunities exist for VMGs in cashew nut grading E: Case studies/profiles of success stories • Profitability was higher when the cashew nut processing factory was operational in Kilifi and nuts were purchased based on grades Application guidelines for users • Cashew planting guide, KALRO Mtwapa 3. KALRO Cashew Nut https://play.google.com/store/apps/details?id=com.andromo.dev72 4321.app928007 4. Cashew Nut Production, A reference handbook for farmers in Kenya, F.K. Muniu Website: www.kalro.org 5. Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima Nchini Kenya, F.K. Muniu F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research) 1. Ready for up scaling G: Contacts Institute Director, KALRO –ICRI Mtwapa Kalro.Mtwapa@kalro.org Contacts KALRO Mtwapa: Pole F	in development,	equipment
scaling up services • There is low adoption by VMGs due lack of awareness VMG related opportunities • Employment opportunities exist for VMGs in cashew nut grading E: Case studies/profiles of success stories • Profitability was higher when the cashew nut processing factory was operational in Kilifi and nuts were purchased based on grades Application guidelines for users 1. Cashew planting guide, KALRO Mtwapa 2. Cashew for Cash booklet, KALRO Mtwapa 3. KALRO Cashew Nut https://play.google.com/store/apps/details?id=com.andromo.dev72 4321.app928007 4. Cashew Nut Production, A reference handbook for farmers in Kenya, F.K. Muniu Pthray Bora wa Mkorosho, Mwongozo wa Wakulima Nchini Kenya, F.K. Muniu F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research) 1. Ready for up scaling G: Contacts Institute Director, KALRO –ICRI Mtwapa Kalro.Mtwapa@kalro.org Lead organization and scientists KALRO Mtwapa: Muniu F., Mwashumbe S and Menza M.	dissemination, adoption and	• VMGs have limited access to education, training and extension
• There is low adoption by VMGs due lack of awareness VMG related opportunities Employment opportunities exist for VMGs in cashew nut grading E: Case studies/profiles of success stories Success stories • Profitability was higher when the cashew nut processing factory was operational in Kilifi and nuts were purchased based on grades Application guidelines for users 1. Cashew planting guide, KALRO Mtwapa 2. Cashew for Cash booklet, KALRO Mtwapa 3. KALRO Cashew Nut https://play.google.com/store/apps/details?id=com.andromo.dev72 4321.app928007 4. Cashew Nut Production, A reference handbook for farmers in Kenya, F.K. Muniu Website: www.kalro.org 5. Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima Nchini Kenya, F.K. Muniu 1. Ready for up scaling F: Status of TIMP 1. Ready for up scaling Readiness (1. Ready for up scaling 1. Ready for up scaling Contacts Institute Director, KALRO –ICRI Mtwapa Kalro.Mtwapa@kalro.org Contacts KALRO Mtwapa: Muniu F., Mwashumbe S and Menza M. scientists	scaling up	services
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scientists KALRO Matuga: Pole F	Lead organization and	KALRO Mtwapa: Muniu E Mwashumbe S and Menza M
	scientists	KALRO Metuga: Pole E
Partner organizations and Pwani University info@pu ac ke S. Muti: H. Saba	Partner organizations and	Pwani University info@pu ac ke S Muti: H Saha
contacts Coast Development Authority, J. Kombe	contacts	Coast Development Authority, J. Kombe
GAPS	GAPS	
1. Develop cashew nut grading systems	1. Develop cashew nut gra	ding systems

2.7.3 Sorting and grading

TIMP Name	Sorting and grading	
Category (technology,	Management Practice	
innovation or management		
practice)		
A: Description of the technology, innovation or management practice		
Problem to be addressed	Poor quality nuts due to pulp remaining on the nuts, and presence of	
	immature, empty and sprouted nuts	
What is it? (TIMP description)	Sorting involves the removal of immature, diseased, shriveled,	
	damaged, empty and sprouted nuts. grading is the grouping of nuts	
	according to size, shape, weight and colour.	

Justification	Nuts with pulp residue cause the nuts to rot leading to lower nut	
	prices. Grading and sorting ensure removal of spoilt nuts and	
	guarantee a high product quality.	
B: Assessment of dissemination	and scaling up/out approaches	
Users of TIMP	Farmers, agripreneurs, extensions, traders, processors	
Approaches used in	• Use of on-farm demos exhibition during field days farmer to	
dissemination	farmer training and agricultural shows	
	• Mass media (TV and radio programs promotional materials	
	leaflets posters brochures manuals and namphlets)	
	• Use of digital platforms comprising web materials mobile	
	• Use of digital platforms comprising web materials, mobile talaphone applications and short massage services (SMS)	
	Development applications and short message services (SIVIS)	
	• Regular localized meetings	
	• Farmer field and business Schools (FFBS)	
	• Agricultural Innovation Platforms (AIP)	
	• Public and private agricultural extension services.	
Critical/essential factors for	• Willingness of farmers to learn, extension support	
successful promotion	• Farm labour must be organized in advance to make nut collection	
	as efficient as possible	
	• Supporting County government grading regulations.	
Partners/stakeholders for scaling	• Agricultural Extension Service-Farmer sensitization, On farm	
up and their roles	and on station demonstrations	
-	• Farmer leaders - Group organization	
	• NGOs dealing with cashew - Dissemination of the practices	
C: Current situation and future scaling un		
Counties where already	Kilifi, Kwale and Lamu	
promoted if any		
Counties where TIMP will be	Kwale, Kilifi and Lamu	
up scaled		
Challenges in dissemination	• Lack of awareness among traders and farmers on appropriate	
	harvesting technology	
	• Negative attitude by farmers towards adoption of new	
	management practices.	
Suggestions for addressing the	• Awareness creation about the technology to farmers and traders	
challenges	• Capacity building of farmers on appropriate harvesting and	
	provide data on the economic gains likely to be made through	
	adoption of the management practices.	
Lessons learned in up scaling if		
any		
Social, environmental, policy	• Awareness creation of advantages of health benefits of cashew	
and market conditions necessary	nuts consumption	
for development and up scaling	• Frequent policy review to encourage consumption of cashew nuts	
D: Economic, gender, vulnerat	ble and marginalized groups (VMGs) considerations	
Basic costs	To yet determined	
Estimated returns	Reduced losses, better income and nutrition (due to utilization of	
	saved nut)	
Gender issues and concerns in	• In the target county, cashew is mainly cultivated by women	
development, dissemination.	hence these should be targeted	
1 1 , the second s		
adoption and scaling up	• The TIMP may be easily adoptable after training and many	

	during and after harvesting.
Gender related opportunities	The TIMP increases farm income through reduction of harvest losses.
	Women can capitalize on this aspect of cashew production to reduce
	harvest losses
VMG issues and concerns in	• Manual harvesting can be practices by energetic women and
development, dissemination,	youth.
adoption and scaling up	• Mechanical harvesting can be encouraged to all gender, including the VMGs.
VMG related opportunities	Adoption of the TIMPs implies reduced losses, hence more cashew
	nut available for consumption and sale. This will enable VMGs to
	have enough cashew nut to consume, hence get macro- and micro-
	nutrients (especially minerals). There will be more income for the
	farmers (VMGs).
E: Case studies/profiles of succ	ess stories
Success stories from previous	
similar projects	
Application guidelines for users	Cashew nut harvesting leaflets and manuals
F: Status of TIMP readiness	2. Require validation
(1-ready for upscaling, 2-	
requires validation; 3-requires	
further research)	
G: Contacts	
Contacts	
Lead organization and scientists	KALRO: Wayua F., Ndambuki J.
Partner organizations and contacts	Agricultural University Colleges, MoALD, NGOs, CBOs

284	Drving	of	cashew	kernel
2.0.4	Drying	UI	cashew	Kerner

I IMP Name	Drying of cashew Kernel
Category (technology,	Technology
innovation or management	
practice)	
A: Description of the technology	ogy, innovation or management practice
Problem to be addressed	Postharvest loss due to mycotoxin contamination of poorly dried
	cashew kernel.
What is it? (TIMP description)	It is the drying of cashew kernel in open sunshine, or in mechanized
	solar dryers and electricity powered dryers, which are fast and
	efficient. This drying reduces the moisture content to 8-10%, which is
	for safe storage without spoilage. Drying of cashew kernels
	immediately after dehusking is essential in preserving the quality of the
	kernels. Well dried kernels produce a rattling sound when turned on
	the drying rack. Dry kernels have a brown colour. It is advisable to use
	a moisture meter for accurate determination of moisture content.

	Greenhouse solar driver for agricultural produce (Source: Wayne	
Instification	Well dried cashew kernels eliminate mycotoxin contamination of the	
Justification	cashew kernels and is important for safe storage. The dry cashew	
	kernels can keep for eight months or more provided that they are dried	
	to moisture content of 10% or below packed in sealed polythene bags	
	and stored under dry conditions	
B: Assessment of dissemination	on and scaling up/out approaches	
Users of TIMP	Farmers, agripreneurs, extension service, traders, processors	
Approaches used in	• Use of on-farm demos, exhibition during field days, farmer to	
dissemination	farmer training and agricultural shows	
	• Mass media (TV and radio programs, promotional materials	
	leaflets, posters, brochures, manuals and pamphlets)	
	• Use of digital platforms comprising web materials, mobile	
	telephone applications and short message services (SMS)	
	Regular localized meetings	
	• Farmer field and business Schools (FFBS)	
	Agricultural Innovation Platforms (AIP)	
	• Public and private agricultural extension services.	
Critical/essential factors for	• Willingness of farmers to learn	
successful promotion	• Availability of extension services	
-	• Funding availability to farmers through loans or cooperatives to	
	enable them invest in the drying system.	
Partners/stakeholders for	• Extension services – Forn farmer sensitization and on-farm and on-	
scaling up and their roles	station demonstrations.	
	• Farmer leaders: Assist in farmer groups organization	
	• NGOs dealing with cashew - For dissemination of the management	
	practice	
C: Current situation and future scaling up		
Counties where already	Kilifi, Kwale, Lamu	
promoted if any	T	
Counties where I IMP will be	Lamu	
Challenges in dissemination	Lack of local availability of dryars	
Suggestions for addressing the	Adopting public-private-partnerships so that the private sector can	
challenges	stock the drivers closer to farmers and charge a fee for their usage	
	Farmer groups to be given affordable credit facilities to acquire	
	the solar drvers	
Lessons learned in up scaling	Partnership is important in technology dissemination	
if any	Extension training and regular monitoring are essential	

Social, environmental, policy	Drying requires sunshine. Sun drying requires three days of full	
and market conditions	exposure to sunlight during the dry season. Greenhouse solar driers	
necessary for development and	take less time.	
up scaling		
D: Economic, gender, vulnera	able and marginalized groups (VMGs) considerations	
Basic costs	To yet determined	
Estimated returns	Not yet determined	
Gender issues and concerns in	• The technology reduces postharvest losses and, therefore,	
development, dissemination,	women and youth can afford to produce cashew.	
adoption and scaling up	• Use of dryers will not overburden any gender in implementation	
	and therefore have potential for adoption by both genders.	
Gender related opportunities	 Opportunities for youth in offering cashew nut drying services to 	
	farmers	
VMG issues and concerns in	The management practices reduce postharvest losses, hence more	
development, dissemination,	cashew nut to be consumed and sold	
adoption and scaling up		
VMG related opportunities	Adoption of the TIMPs means reduced losses, hence more cashew	
	products available for consumption and sale. This will enable	
	VMGs to have enough cashew products to consume, hence get macro-	
	and micro-nutrients (especially minerals). There will be more income	
	for the farmers (VMGs).	
E: Case studies/profiles of suc	ccess stories	
Success stories from previous	None	
similar projects		
Application guidelines for	Cashew drying leaflets and manuals	
users		
F: Status of TIMP	2 Require validation	
readiness (1-ready for		
upscaling; 2-requires		
validation; 3-requires further		
research)		
G: Contacts		
Contacts		
Lead organization and	KALRO: Wayua F., Ndambuki J.	
scientists		
Partner organizations and	Agricultural University Colleges, MoALD, NGOs, CBOs	
contacts		

1. Validating greenhouse solar drying of cashew kernels in difference agro-ecological zones

2.0.5 Jute sacks and cashe what stores		
TIMP Name	Jute sacks and cashew nut stores	
Category (technology,	Technology	
innovation or management		
practice)		
A: Description of the technology, innovation or management practice		
Problem to be addressed	Postharvest losses due to inappropriate packaging and storage	
	containers	
What is it? (TIMP description)	Packaging cashew in Jute bags to help prevent excessive build-up	

2.8.5 Jute sacks and cashew nut stores

of moisture during storage and transportation. The bags are stacked in a raised platform such as wooden platform or logs to prevent moisture from entering the nuts from the floor. At least 0.5 m space should be left between stacks, between stacks and walls, and also below the roof to allow free circulation of air as well as for individuals to walk and check the condition of the sacks.

Sack storage of cashew nut (Source: Costa and Bochi, 2017)

Justification	Good storage of cashew kernels in jute sacks maintains quality of
	the nut, prevents mycotoxin contamination and extends its shelf-
	life.
B: Assessment of dissemination a	nd scaling up/out approaches
Users of TIMP	Farmers, agripreneurs, extension service officers, traders and
	processors
Approaches used in dissemination	 Use of on-farm demos, exhibition during field days, farmer to farmer training and agricultural shows Mass media (TV and radio programs, promotional materials leaflets, posters, brochures, manuals and pamphlets) Use of digital platforms comprising web materials, mobile telephone applications and short message services (SMS) Regular localized meetings Farmer field and business Schools (FFBS)
	• Agricultural Innovation Platforms (AIP)
	• Public and private agricultural extension services.
Critical/essential factors for	• The nuts to be stored should be well-dried to moisture
successful promotion	content of 8%.
	• Stitch jute sacks tightly to avoid spillage
	• Sell nuts within the same year of harvest to prevent quality loss.
Partners/stakeholders for scaling up and their roles	 Extension service - Farmer sensitization and on-farm and on-station demonstrations Farmer leaders -Conduct farmer groups organization NGOs dealing with cashew nut – Assist in dissemination of the management practice.
C: Current situation and future s	scaling un
Counties where already promoted if any	Kilifi, Kwale, Lamu
Counties where TIMP will be up scaled	Lamu
Challenges in dissemination	Lack of jute bags close the farmers who need them
6	Lack of awareness on the usage good stores that keep the cashew kernel dry.
Suggestions for addressing the challenges	 Adopting public-private-partnerships, so that the private sector can stock the jute bags closer to farmers and sell them to Farmer groups at affordable prices. Encourage building and use of good stores that allow the stored cashew kernels to remain viable.

Lessons learned in up scaling if	• Partnership is important in technology dissemination
any	• Extension training and regular monitoring are essential
Social, environmental, policy and	• Jute sacks need to be acceptable to the farmers and traders.
market conditions necessary for	• Although the sacks are imported, there should policy
development and up scaling	guidelines to ensure they are affordable
	 The traders may consider recycling the bags especially
	where the same are returned to them by processors
	• Draft plans for suitable stores made from locally available
	• Drait plans for suitable stores made from locally available
	affective
D. Faanamia gandar yulnarahla	and marginalized groung (VMCg) considerations
D: Economic, gender, vumerable	To yet determined
Estimated returns	Not yet determined
Condeniosues and concerns in	
Gender issues and concerns in	• The technology reduces postharvest losses and, therefore,
development	women and youth can afford to produce cashew.
,dissemination, adoption and	• Use of the jute bags and good stores will not overburden
scaling up	any gender in implementation and therefore have potential
	for adoption by both genders.
Gender related opportunities	Opportunities for youth in offering cashew nut packaging services
	to farmers
VMG issues and concerns in	The technology reduce postharvest losses, hence more cashew nut
development, dissemination,	to be consumed and sold
adoption and scaling up	
VMG related opportunities	Adoption of the technology stands to reduce losses, hence more
	cashew nut available for consumption and sale. This will enable
	VMGs to have enough cashew nut to consume, hence get macro-
	and micro-nutrients (especially minerals). There will be more
	income for the farmers (VMGs).
E: Case studies/profiles of succes	s stories
Success stories from previous	
similar projects	
Application guidelines for users	Cashew nut drying leaflets and manuals
F: Status of TIMP readiness	2. Require validation
(1-ready for upscaling; 2-requires	
validation; 3-requires further	
research)	
G: Contacts	
Contacts	
Lead organization and scientists	KALRO: Wayua F., Ndambuki J.
Partner organizations and contacts	Agricultural University Colleges, MoALD, NGOs, CBOs

2.8.6 Zero energy coooler

TIMP Name	Zero energy cooler
Category (technology,	Technology
innovation or management	
practice)	
A: Description of the technology, innovation or management practice	
Problem to be addressed	High postharvest losses (30%) due to lack of appropriate cooling

	technology for cashew apple at farm level.
What is it? (TIMP description)	Zero-energy cooler is an evaporative cold storage that offers short time
	storage for fresh produce. It reduces the temperature and increases
	relative humidity during storage essential in maintaining the freshness
	of the cashew apple.
	the second s
	North Contract of the second s
	The second states and a second states and second
	Zero energy cooler
Justification	Cashew apples are highly perishable therefore they should be stored at
	low temperature and high relative humidity to enhance their shelf life.
	High temperature increases respiration rate and enhances postharvest
	rots. Cooling cashew apple at farm level improves the shelf life and
	maintains quality. Use of the zero energy unit offers cost effective cold
	storage unit. The unit is made using locally available materials that are
	environmentally friendly.
B: Assessment of dissemination	on and scaling up/out approaches
Users of TIMP	Farmers, extensions, traders, processors
Approaches used in	• Use of on-farm demos, exhibition during field days, farmer to
dissemination	farmer training and agricultural snows
	• Mass media (1 v and radio programs, promotional materials
	• Use of digital platforms comprising web materials mobile
	telephone applications and short message services (SMS)
	 Regular localized meetings
	 Farmer field and business Schools (FFBS)
	 Agricultural Innovation Platforms (AIP)
	 Public and private agricultural extension services.
Critical/essential factors for	 Willingness of farmers to learn how to make and use the zero-
successful promotion	energy unit
1	• Availability of the extension service support to train farmers
	 Funding for the initiative to extend reach to many farmers
Partners/stakeholders for	• Extension service - Farmer sensitization n farm and on station
scaling up and their roles	demonstrations
	• Farmer leaders – Farmer groups organization
	• NGOs dealing with cashew nut - Funding and dissemination of the
	practices
C: Current situation and futu	re scaling up
Counties where already	None

promoted if any	
Counties where TIMP will be	Lamu
up scaled	
Challenges in dissemination	• Inadequate skills in construction
	• High labour costs in construction
	• Lack of organized marketing structure for the apples and its value-
	added products
Suggestions for addressing the	None
challenges	
Lessons learned in up scaling	None
if any	
Social, environmental, policy	• The local populace should be will to learn how to make the zero-
and market conditions	energy storage and use it
necessary for development and	• Local artisans trained to make the cold storage shood charge
up scaling	reasonably to be able to earn a living from their skills
	• Organized marketing channels is critical for benefits to be
	derived from technology
D: Economic, gender, vulnera	ble and marginalized groups (VMGs) considerations
Basic costs	To yet determined
Estimated returns	Not yet determined
Gender issues and concerns in	Technology can be easily applied by all gender categories
development, dissemination,	
adoption and scaling up	
Gender related opportunities	All gender categories can easily use the technology to ensure cashew
	nut quality is maintained
VMG issues and concerns in	Participation of some VMGs in capacity building sessions may be
development, dissemination,	a challenge.
adoption and scaling up	
VMG related opportunities	The technology enhances opportunities for commercial venture for
	VMGs
E: Case studies/profiles of suc	ccess stories
Success stories from previous	None
similar projects	
Application guidelines for	Cashew nut leaflets and manuals
users	
F: Status of TIMP	2. Require validation
readiness (1-ready for	
upscaling; 2-requires	
validation; 3-requires further	
research)	
G: Contacts	
Contacts	
Lead organization and	KALRO F. Wayua, J. Ndambuki
scientists	
Partner organizations	Agricultural University Colleges, MoALD, NGOs, CBOs

GAPS Cooling technologies for cashew nuts

TIMP Name	Modified Atmosphere packaging
Category (technology, innovation or	Technology
management practice)	
A: Description of the technology, innova	ntion or management practice
Problem to be addressed	High postharvest losses that occur due to high perishability
	of cashew kernel.
What is it? (TIMP description)	Modified Atmospheric Packaging (MAP) is the use of barrier packaging material such as polybags that controls exchange of gas in and out of packaging containers. The packaging material allows modification of gas inside creating a suitable atmosphere to improve the shelf life of produce. The modification lowers amount of oxygen and increases gases such as carbon dioxide and nitrogen. Low levels of oxygen reduce rate of respiration and infestation by pathogens thus improving the shelf life of cashew kernel.
Cashew kernel modified atmosphere	
Justification	Cashew kernel are highly perishable, proper packaging enhances their shelf life. High respiration rate during packaging increases postharvest losses. Modified Atmosphere Packaging reduces respiration rate due to modification of gas inside the package and is a technology that should be promoted.
B: Assessment of dissemination and scal	ing up/out approaches
Users of TIMP	Farmers, agripreneurs, extension service, traders, processors and researchers
Approaches used in dissemination	 Use of on-farm demos, exhibition during field days, farmer to farmer training and agricultural shows Mass media (TV and radio programs, promotional materials leaflets, posters, brochures, manuals and pamphlets) Use of digital platforms comprising web materials, mobile telephone applications and short message services (SMS) Regular localized meetings Farmer field and business Schools (FFBS) Agricultural Innovation Platforms (AIP) Public and private agricultural extension services.
Critical/essential factors for successful	• Willingness of farmers to learn
promotion	Extension service supportFunding to reach most farmers
Partners/stakeholders for scaling up and their roles	 Extension service - Farmer sensitization through on-farm and on-station demonstrations Farmer leaders - Farmer groups organization NGOs dealing with cashew - Funding and

2.8.7 Modified Atmosphere packaging

	dissemination of the practices
C: Current situation and future scaling	սթ
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Lamu
Challenges in dissemination	Limited information on this technology
Suggestions for addressing the challenges	Awareness creation about the technology to farmers and
	traders
Lessons learned in up scaling if any	Farmer participatory approach works
Social, environmental, policy and market	• Improved dissemination of the technology among all
conditions necessary for development and	social groups that target the farmers.
up scaling	• Explain to farmers the environmental benefits of this
	technology.
	• Organized marketing channels is critical for benefits
	to be derived from technology
D: Economic, gender, vulnerable and m	arginalized groups (VMGs) considerations
Basic costs	To yet determined
Estimated returns	Not yet determined
Gender issues and concerns in	The technology can be easily practised by all gender
development, dissemination, adoption and	categories - Cost may be prohibitive for some requirements
scaling up	
Gender related opportunities	All gender categories can easily use the technology to
	ensure good cashew kernel quality is maintained
VMG issues and concerns in development,	Important to consider VMGs issues when promoting the
dissemination, adoption and scaling up	technology -The activity is suitable for VMGs
VMG related opportunities	Offers opportunities for commercial venture for VMGs
E: Case studies/profiles of success stories	5
Success stories from previous similar	None
projects	
Application guidelines for users	Leaflets and manuals
F: Status of TIMP readiness (1-ready	2. Require validation
for upscaling; 2-requires validation; 3-	
requires further research)	
G: Contacts	
Contacts	
Lead organization and scientists	KALRO: Wayua F., Ndambuki J.
Partner organizations and contacts	Agricultural University Colleges, MoALD, NGOs, CBOs

1. Validation of packaging technologies for kernels.

2.9 Cashew Value Addition

2.9.1 Cashew nut drum roaster

TIMP Name	Cashew nut drum roaster
Category (technology, innovation	Innovation
or management practice)	
A: Description of the technology, innovation or management practice	
Problem to be addressed	Poor quality of locally processed nuts
What is it? (TIMP description)	Use of cashew shell liquid for processing cashew nut using a drum
	to produce clean and whole kernels

Justification	There is high demand for roasted cashew nuts in the domestic market
	Processing using a drum roaster ensures clean kernels and of good
	grades for better prices. Cottage processing through drum roasting
	stand to open up employment opportunities in the cashew growing
	areas.
	Grades
	Quality grade roasted whole kernels
B: Assessment of dissemination	and scaling up/out approaches
Users of TIMP	Producers, agripreneurs, traders, cottage processors
Approaches used in dissemination	• Use of on-farm demos, exhibition during field days, farmer to
	farmer training and agricultural snows
	• Mass media (1V and radio programs, promotional materials
	Lies of digital platforms comprising was materials, mahila
	• Use of digital platforms comprising web materials, mobile telephone applications and short message services (SMS)
	 Pagular localized mastings
	 Regular localized incentings Former field and business Schools (EEDS)
	• A gricultural Innovation Distforms (AID)
	 Agricultural innovation reaction (Air) Public and private agricultural extension services
Critical/essential factors for	 Skilled put processors and availability of good quality
successful promotion	raw nuts
	 Encourage participation of women and youth groups
	 Capacity building on food processing
Partners/stakeholders for scaling	Cashew nut growers- production of raw nuts
up and their respective roles.	• Extension workers-Capacity building and dissemination
	 NGOs, Private service providers- Dissemination and
	upscaling
Counting where already	scaling up
promoted, if any	KIIII, KWalt, Laillu
Counties where TIMPs will be upscaled	Kilifi, Kwale, Lamu
Challenges in development and	• Low interest in training in the new processing technology
dissemination	among men
	• Lack of specialized equipment for the trained cashew cottage
	processors
Suggestions for all the state	• Supply of mixed grade cashew kernels
challenges	• I raining of women and youth groups in processing in addition to the few men willing to train
	Provision of suitable financial facilities to purchase equipment
	for processing
	Encourage uptake grading of cashew kernels to ensure a steady

	supply of the much-needed quality cashew kernels
	 Encourage more participation of NGOs/private partnerships in
	promoting local processing
Lassons loarned in up scaling if	Deer hydright in processing markeding and handling needs to
Lessons learned in up scaling, if	• Poor nygiene in processing, packaging and nanding needs to
	be addressed
Social, environmental, policy and	• There is need to explore sustainable energy options for
market conditions necessary for	cashew processing.
development and up- scaling	• There is an opportunity to explore cashew nut shell as a
	bioenergy source in cashew processing
	• Potential negative environmental effects such as greenhouse
	gas emissions, deforestation for wood fuel, need to be
	mitigated.
D: Economic, gender, vulnerabl	e and marginalized groups (VMGs) considerations
Basic costs	Not yet determined
Estimated feturits	
Gender issues and concerns in	• Women and youth have limited access to credit to purchase
development, dissemination,	the roasting equipment
adoption and scaling up	• Women and youth have limited access to education, training
	and extension services than men
	• Men dominate decisions on cashew at the household
	and community
Gender related opportunities	• Employment opportunities exist for women in cashew nuts
	processing
VMG issues and concerns in	• VMGs have limited access to credit to purchase the roasting
development, dissemination.	equipment
adoption and scaling up	• VMGs have limited access to education training and
	extension services than men
	• There is low adoption by VMCs due look of averages
VMC related and straiting	• There is low adoption by vivios due tack of awareness
VMG related opportunities	• Employment opportunities exist for VMGs in cashew nuts
	processing
	• Affirmative action opportunities such as the women and
	youth enterprise fund exist for VMGs to access the required
	credit to procure drum roasters and packaging materials,
	branding etc.
E: Case studies/profiles of succe	ss stories
Success stories	Applied successfully in Kilifi and Kwale
Application guidelines for users	1. Cashew planting guide, KALRO Mtwapa
	2. Cashew for Cash booklet, KALRO Mtwapa
	3. KALRO Cashew Nut
	https://play.google.com/store/apps/details?id=com.andromo.
	dev724321.app928007
	4. Cashew Nut Production, A reference handbook for farmers
	in Kenya, F.K. Muniu Website: www.kalro.org
	5. Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima
	Nchini Kenya, F.K. Muniu
F: Status of TIMP Readiness (1.	1. Ready for up scaling
Ready for up scaling; 2. Requires	
validation; 3. Requires further	

research)	
G: Contacts	
Contacts	Institute Director, KALRO –ICRI Mtwapa
	Kalro.Mtwapa@kalro.org
Lead organization and scientists	KALRO, Mtwapa: Muniu F., Menza M., Mwashumbe S.
	KALRO Matuga, Pole F.
Partner organizations and	Pwani University, info@pu.ac.ke. W. Mbinda, Saha H.
contacts	
GAPS	

- Adoption of food safety standards in processing of cashew nut through drum roasting Validation of appropriate packaging methods •
- •

a.).a Roastea casitew nut			
TIMP name	Roasted cashew nut		
Category (technology, innovation or management practice)	Technology		
Problem addressed	• Limited utilisation of Cashew nut		
	• High postharvest losses for cashew nut		
What is it? (TIMP	This is the cooking of cashew nuts made by roasting. This method of		
description)	cooking confers a unique aroma and taste to the cooked cashews nuts.		
Iustification	<i>Roasted cashew nut Source: Internet</i> Diversification of cashew nut value added food products is the best		
Justification	bit to enhance the consumption of eachery put increase demand and		
	bet to enhance the consumption of cashew hut, increase demand and		
	thus spur ampiny production. Dried cashew hut can be roasted to		
	make roasted cashew nut. Roasting cashew nut brings out the		
	and nutrition.		
B: Assessment of dissemina	tion and scaling up/out approaches		
Users of TIMP	Farmers, farmer groups, cottage processors, traders, agripreneurs, extension service agents, KEBS, industrial and commercial processors		
Approaches to be used in dissemination	 Use of on-farm demos, exhibition during field days, farmer to farmer training and agricultural shows Mass media (TV and radio programs, promotional materials leaflets, posters, brochures, manuals and pamphlets) Use of digital platforms comprising web materials, mobile telephone applications and short message services (SMS) Regular localized meetings Farmer field and business Schools (FFBS) Agricultural Innovation Platforms (AIP) 		

Roasted cashew nut 292

	Dublic and private agricultural extension services
Critical/accortical factors for	Tuble and private agricultural extension services.
Critical/essential factors for	• Participatory implementation through phased out incubation.
successful promotion	• Stakenoider capacity building and networks inrough
	• Awaranass greation of high value added products of asshow
	• Awareness creation of high value-added products of cashew
	Products.
	• Filvat Fublic Fatherships to increase production of high-
Doute ous /stalsal aldous for	quality cashew hut products.
Partners/stakenoiders for	• Farmer groups – Provide land for establishment of small-
scaling up and their roles	scale roasted cashew nut processing facility
	• Extension service providers (Public and private - Help in the
	dissemination
	• KALRO – Train trainers and provide technical backstopping
	on dissemination of roasted cashew nut technology
	• KEBS – Standards formulation for roasted cashew nut,
	certification of private roasted cashew nut processors
	Supermarkets and retailers will provide markets for the
	roasted cashew nut.
C: Current situation and fut	ure scaling up
Counties where already	Kwale, Kilifi, Tana River and Lamu
promoted, if any	
Counties where TIMPs will	Kwale, Kilifi, Tana River and Lamu
be upscaled	
Challenges in dissemination	• Limited awareness of the product by the farmers
C C	• Lack of processing technology at the household level
	 Difficulty in understanding how to seek certificates from
	• Difficulty in understanding now to seek certificates from
	• Lack knowledge of necessity for standards for the product
	• Limited consumer awareness of value-added cashew
	products.
Suggestions for addressing the	• Awareness creation about the product to farmers, consumers
challenges	and other value chain actors
	• Capacity building of farmers on how to prepare the product
	 Information dissemination posthervest handling value
	addition and nutritional attributes of the product
	• Involvement of regulatory agencies and policy makers in up
	scaling process
	• Linkage to credit facility providers to promote
	commercialization, advocacy for standards development for
	value added cashew products; nutrition education to
	consumers.
Lessons learned in up	Roasted cashew nut is most preferred snack and fetch good prices
scaling, if any	
Social, environmental,	• Target women and youth as entrepreneurs in society who are
policy and market conditions	the major adopters (manufacturers) and consumers.
necessary for development	respectively.
and up scaling	 Establish the value addition cottage near the sources of cashew
and up bounds	nut to reduce on operational costs

	 Develop quality standards for cashew nut to propel its commercialization Farmer groups may need to align their cottage processing facilities to existing government policies. 	
D: Economic, gender, vulner	able and marginalized groups (VMGs) considerations	
Basic costs	Not yet	
Estimated returns	Not yet	
Gender issues and concerns in	• Women and youth have limited access to productive resources	
development, dissemination	such as land, credit, and quality seeds than men	
adoption and scaling up		
	• Women and youth have limited access to education, training	
	and extension services than men	
	 Women tend to nave finited access to markets Women have loss access to agricultural information, technology 	
	• Women have less access to agricultural information, technology and knowledge	
	 Men dominant most decisions at the household and community 	
	levels	
Gender related opportunities	• Women and youth stand to benefit in production, use and sale	
	of roasted cashew nut.	
VMG issues and concerns in	• VMGs have limited access to productive resources such as land,	
development, dissemination	credit, and quality seeds	
adoption and scaling up	• VMGs have limited access to training and extension services	
	• VMGs have limited access to markets as they sometimes cannot	
	travel to far regional markets due to either their sickness,	
	disability of lack of exposure	
	 Due to their social status visios are often excluded from decision making in development and dissemination activities 	
	• VMGs have limited access to seed and information on new	
	varieties and production techniques	
	 There is low adoption by VMGs due lack of awareness 	
VMG related opportunities	Opportunities exist for VMGs in value adding cashew	
	through roasting.	
	• Affirmative action opportunities such as the women and	
	youth enterprise fund exist for VMGs to access the required	
E: Case studies/profiles of su	creas stories	
Success stories None		
Application guidelines	1 Cashow planting guida KALPO Mtwana	
for users	2 Cashew for Cash booklet, KALRO Mtwapa	
	3 KALRO Cashew Nut	
	https://play.google.com/store/apps/details?id=com.andromo.dev	
	724321.app928007	
	4. Cashew Nut Production, A reference handbook for farmers in	
	Kenya, F.K. Muniu Website: <u>www.kalro.org</u>	
	5. Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima Nchini	
	Kenya, F.K. Muniu	
F: Status of TIMP	2 Requires validation	
readiness (1-Ready for		
upscaling, 2- requires		

validation, 3-requires	
further research)	
G: Contacts	
Contacts	Institute Director, KALRO –ICRI Mtwapa Kalro.Mtwapa@kalro.org
Lead organization and	KALRO
scientists	F. Wayua, J. Ndambuki
Partner organizations and	Agricultural University Colleges, MoALD, NGOs, CBOs
Contacts	

- 1. Evaluation of cashew varieties which can be used in processing of roasted cashew nut.
- 2. Optimization of the roasting process
- 3. Low-cost packaging materials

2.9.3 Cashew nut butter

TIMP name	Cashew nut butter
Category (technology, innovation or management practice)	Technology
A: Description of the technol	ogy, innovation or management practice
Problem addressed	 Limited utilisation of cashew nut High postharvest losses for cashew nut
What is it? (TIMP description)	This is a spread made from baked or roasted cashew nuts that may be used on bread as well as in soups or sauces. It is creamy in flavour, and rich in protein, unsaturated fats and vitamins. It is made using After removing the cashew nuts whose shell have been removed and then roasted. The roasted product is processed into butter.
	Cashew nut butter
Justification	Diversification of cashew nut food products is a sure bet to
	enhancing consumption of cashew nut, enhance demand and thus
B: Assessment of disseminati	on and scaling un/out approaches
Ligger of TIMD	Tradara agripropours option convice agents, acting and large
	commercial processors

Approaches to be used in	• Use of on-farm demos, exhibition during field days, farmer to
dissemination	farmer training and agricultural shows
	• Mass media (TV and radio programs, promotional materials
	leaflets, posters, brochures, manuals and pamphlets)
	• Use of digital platforms comprising web materials, mobile
	telephone applications and short message services (SMS)
	Regular localized meetings
	• Farmer field and business Schools (FFBS)
	Agricultural Innovation Platforms (AIP)
	Public and private agricultural extension services.
Critical/essential factors for	• Target women and youth as entrepreneurs in society who are
successful promotion	the major adopters (manufacturers) and consumers,
	respectively.
	• Establish the value addition cottage near the sources of cashew
	nut to reduce on operational costs
	• Develop quality standards for cashew nut to proper its
	Commercianzation
	• Farmer groups may need to angle their cottage processing facilities to existing government policies
Partners/stakeholders for	Earmon groups Provide land for establishment of small
scaling up and their roles	• Farmer groups – Provide rand for establishment of small-
scaling up and then roles	• Extension service providers (Public and private Help in the
	• Extension service providers (Fublic and private - Help in the dissemination
	 KALRO – Train trainers and provide technical backstopping
	on dissemination of roasted cashew nut technology
	 KEBS – Standards formulation for roasted cashew nut
	certification of private roasted cashew nut processors
	Supermarkets and retailers will provide markets for the
	roasted cashew nut.
C: Current situation and fut	are scaling up
Counties where already	Kilifi , Kwale, Lamu
promoted,	
II any Counties where TIMPs will be	Kilifi Kwala Lamu
upscaled	Kinni, Kwale, Lanu
Challenges in dissemination	• Limited awareness of the product by the farmers
	• Lack of processing technology at the household level
	• Difficulty in understanding how to seek certificates from
	regulatory authorities
	• Lack knowledge of necessity for standards for the product
	• Limited consumer awareness of value-added cashew products.
Suggestions for addressing the	• Awareness creation about the product to farmers. consumers
challenges	and other value chain actors
_	• Capacity building of farmers on how to prepare the product
	• Information dissemination – postharvest handling, value
	addition, and nutritional attributes of the product

	• Involvement of regulatory agencies and policy makers in up
	scaling process
	• Linkage to credit facility providers to promote commercialization, advocacy for standards development for value added cashew products; nutrition education to consumers.
Lessons learned in up	• Cashew nut butter is easy to make thus enhance utilization of
scaling, if any	cashew.
Social, environmental, policy	• Target women and youth as entrepreneurs in society who are
and market conditions	the major adopters (manufacturers) and consumers,
necessary for development and	respectively.
up scaling	• Establish the value addition cottage near the sources of cashew nut to reduce on operational costs
	 Develop quality standards for cashew nut to propel its
	commercialization
	• Farmer groups may need to align their cottage processing facilities to existing government policies.
D: Economic, gender, vulner	able and marginalized groups (VMGs) considerations
Basic costs	Not yet
Estimated returns	Not yet
Gender issues and concerns	• Women and youth tend to have limited access to credit to
in development,	purchase the required equipment
dissemination adoption and	• Women and youth have limited access to education, training and
scaling up	extension services than men
	• Women have limited access to markets than men
	• Women have less access to agricultural information, technology
	and knowledge
	• Men dominant most decisions at the nousehold and community levels
Gender related opportunities	Women and youth stand to benefit in production, use and sale
i i i i i i i i i i i i i i i i i i i	of cashew nut butter.
VMG issues and	• VMGs have limited access to credit that can be used to
concerns in	purchase the required implement
development,	• VMGs have limited access to training and extension
dissemination adoption	services
and scaling up	
	• VMGs have limited access to markets as they sometimes cannot
	travel to far regional markets due to either their sickness,
	 Due to their social status VMCs are often evaluated from decision
	• Due to their social status visios are often excluded from decision making in development and dissemination activities
	• VMGs have limited access to seed and information on new
	varieties and production techniques
	• There is low adoption by VMGs due lack of awareness
VMG related opportunities	Opportunity to produce, trade in, and consume locally produced
	cashew nut butter products
	• All reaction opportunities such as the women and youth
	procure drum roasters and packaging materials, branding etc.
E: Case studies/profiles of su	ccess stories

Success stories		
Application guidelines for	6. Cashew planting guide, KALRO Mtwapa	
users	7. Cashew for Cash booklet, KALRO Mtwapa	
	8. KALRO Cashew Nut	
	https://play.google.com/store/apps/details?id=com.andromo.dev7	
	<u>24321.app928007</u>	
	9. Cashew Nut Production, A reference handbook for farmers in	
	Kenya, F.K. Muniu Website: <u>www.kalro.org</u>	
	10. Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima Nchini	
	Kenya, F.K. Muniu	
F: Status of TIMP	2. Requires validation	
readiness (1- Ready for		
upscaling, 2-requires		
validation, 3-requires		
further		
research)		
G: Contacts		
Contacts	Institute Director, KALRO –ICRI Mtwapa Kalro.Mtwapa@kalro.org	
Lead organization and	KALRO: Wayua F., Ndambuki J.	
scientists		
Partner organizations and	Agricultural University Colleges, MoALD, NGOs, CBOs	
contacts		

Research and Gaps

- Screen for suitable cashew variety for use in butter production
 Undeveloped food safety plan for the small-scale farmers
- 3. Gross margins

2.7.4 Cashew hat tonee			
TIMP name	Cashew nut toffee		
Category (technology,	Technology		
innovation or management			
practice)			
A: Description of the techno	logy, innovation or management practice		
Problem addressed	Limited utilisation of cashew kernels		
	High postharvest losses for cashew nut		
What is it? (TIMP	This is a confection made from roasted and ground		
description)	cashew kernels to which sugar is added.		
	Cashew nut Toffee		
Justification	Increased diversification of cashew nut food products stand to enhance consumption of cashew nut, enhance demand and thus spur utilization. Sweet taste cashew nut with fine flavour and texture can be processed into		

2.9.4 Cashew nut toffee

	toffee for both commercial and domestic use.			
B: Assessment of dissemina	tion and scaling up/out approaches			
Users of TIMP	Traders, agripreneurs, extension service agents, cottage and large			
	commercial processors			
Approaches to be used in	• Use of on-farm demos, exhibition during field days, farmer to farmer			
dissemination	training and agricultural shows			
	• Mass media (TV and radio programs, promotional materials leaflets,			
	posters, brochures, manuals and pamphlets)			
	• Use of digital platforms comprising web materials, mobile telephone			
	applications and short message services (SMS)			
	Regular localized meetings			
	• Farmer field and business Schools (FFBS)			
	Agricultural Innovation Platforms (AIP)			
	• Public and private agricultural extension services.			
Critical/essential factors for	• Target women and youth as entrepreneurs in society who are the			
successful promotion	major adopters (manufacturers) and consumers, respectively.			
	• Establish the value addition cottage near the sources of cashew nut			
	to reduce on operational costs			
	• Develop quality standards for cashew nut to propel its			
	commercialization			
	• Farmer groups may need to align their cottage processing facilities			
	to existing government policies.			
	• Increased production of high-quality raw cashew nut			
Partners/stakeholders for	• Farmer groups – Provide land for establishment of small- scale			
scaling up and their roles	roasted cashew nut processing facility			
	• Extension service providers (Public and private - Help in the			
	dissemination			
	• KALRO – Train trainers and provide technical backstopping on			
	dissemination of roasted cashew nut technology			
	• KEBS – Standards formulation for roasted cashew nut,			
	certification of private roasted cashew nut processors,			
	supermarkets and retailers will provide markets for the roasted			
	cashew nut.			
C: Current situation and fu	ture scaling up			
Counties where already	Kilifi			
promoted, if any				
Counties where TIMPs will be upscaled	Kwale, Tana River and Lamu			
Challenges in dissemination	• Limited awareness of the product by the farmers			
	• Lack of processing technology at the household level			
	• Difficulty in understanding how to seek certificates from			
	regulatory authorities			
	• Lack knowledge of necessity for standards for the product			
	• Limited consumer awareness of value-added cashew products.			
Suggestions for addressing	• Awareness creation about the product to farmers, consumers and			
the challenges	other value chain actors			
	• Capacity building of farmers on how to prepare the product			
	• Information dissemination – postharvest handling, value addition,			

	and nutritional attributes of the product	
	• Involvement of regulatory agencies and policy makers in up scaling	
	process	
	• Linkage to credit facility providers to promote commercialization,	
	advocacy for standards development for value added cashew	
	products; nutrition education to consumers.	
Lessons learned in up	• There is a ready market for cashew toffee, it is mostly liked by school	
scaling, if any	going children	
Social, environmental,	• Target women and youth as entrepreneurs in society who are the	
policy and market	major adopters (manufacturers) and consumers, respectively.	
conditions necessary for	• Establish the value addition cottage facilities near the sources of	
development and up	cashew nut to reduce on operational costs	
scaling	• Develop quality standards for cashew nut to proper its	
	• Farmer groups may need to align their cottage processing facilities to	
	• Fainter groups may need to angli their cottage processing facilities to existing government policies	
D: Economic, gender, vulne	rable and marginalized groups (VMGs) considerations	
Basic costs	Not vet	
Estimated returns	Not yet	
Gender issues and concerns	• Women and youth have limited access to credit to purchase the	
in development,	required equipment	
dissemination adoption and	• Women and youth have limited access to education, training and	
scaling up	extension services	
	• Women have limited access to markets than men	
	• Women have less access to agricultural information, technology and	
	knowledge	
	• Men dominant most decisions at the household and community levels	
Gender related opportunities	• Women and youth stand to benefit in production, use and sale of cashew nut toffee	
VMG issues and concerns	• VMGs have limited access to credit that can be used to purchase the	
in development	required implement	
dissemination adoption and	• VMGs have limited access to training and extension services	
scaling up	 VMGs have limited access to markets as they sometimes cannot travel 	
seaming up	to far regional markets due to either their sickness, disability or lack	
	of exposure	
	• Due to their social status VMGs are often excluded from decision	
	making in development and dissemination activities	
	• VMGs have limited access to seed and information on new varieties	
	and production techniques	
	• There is low adoption by VMGs due lack of awareness	
VMG related opportunities	• Opportunity for VMGs to produce, trade in, and consume locally	
	produced cashew nut toffee products	
	• Ammative action opportunities such as the women and youth	
	enterprise rund exist for VINGs to access the required credit to	
	others	
E: Case studies/profiles of success stories		
Success stories None		
Application guidelines for	1 Cashew planting guide KAI BO Mtwapa	
Application guidennes 101	1. Cashew planting guide, IXALICO Witwapa	

users	2. C	ashew for Cash booklet, KALRO Mtwapa
	3. K	ALRO Cashew Nut
	<u>h</u> t	ttps://play.google.com/store/apps/details?id=com.andromo.dev7243
	2	<u>1.app928007</u>
	4 . C	ashew Nut Production, A reference handbook for farmers in Kenya,
	F	.K. Muniu Website: <u>www.kalro.org</u>
	5. U	lkuzaji Bora wa Mkorosho, Mwongozo wa Wakulima Nchini Kenya,
	F	.K. Muniu
	6. C	ashew nut toffee production leaflets and manuals
F: Status of TIMP	2 R	equires validation
readiness: (1-Ready for		
upscaling, 2- requires		
validation, 3-requires		
further research)		
G: Contacts		
Contacts	Institute Director, KALRO –ICRI Mtwapa Kalro.Mtwapa@kalro.org	
Lead organization and	KAL	RO: Wayua F., Ndambuki J.
scientists		
Partner organizations and con	tacts	Agricultural University Colleges, MoALD, NGOs, CBOs
CAPS		

- Optimizing the toffee production procedures
 Providing data on gross margins and market demand for cashew nut toffee production

TIMP name	Cashew apple juice	
Category (technology, innovation or management practice)	Technology	
A: Description of the technology	y, innovation or management practice	
Problem addressed	 Limited utilization of cashew apple High postharvest losses for cashew apple 	
What is it? (TIMP description)		
aginu dajitu		
Cashew apple juice	Juice prepared from ripe cashew apple	
Justification	Cashew apple is high in vitamin C more than mango and citrus but it is highly perishable. Through processing cashew apple into juice is a best for enhancing its consumption and increase its shelf	

2.9.5 **Products from cashew apple**

	life for improved nutrition.	
B: Assessment of dissemination and scaling up/out approaches		
Users of TIMP	Farmers, agripreneurs, traders, extension agents, small-scale	
	processors, restaurants, industrial and commercial processors	
Approaches to be used in	• Use of on-farm demos, exhibition during field days, farmer to	
dissemination	farmer training and agricultural shows	
	• Mass media (TV and radio programs, promotional materials	
	leaflets, posters, brochures, manuals and pamphlets)	
	• Use of digital platforms comprising web materials, mobile	
	telephone applications and short message services (SMS)	
	• Regular localized meetings	
	• Farmer field and business Schools (FFBS)	
	Agricultural Innovation Platforms (AIP)	
	Public and private agricultural extension services.	
Critical/essential factors for	• Target women and youth as entrepreneurs in society who	
successful promotion	are the major adopters (manufacturers) and consumers,	
	respectively.	
	• Establish the value addition cottage processing facilities near the sources of each owned to reduce on operational costs	
	Develop quality stondards for asshow put to propality	
	• Develop quality standards for cashew hut to proper its	
	Earmon groups may need to align their actions processing	
	• Farmer groups may need to angle their cottage processing facilities to existing government policies	
	 Increased production of high quality raw cashow put 	
Partners/stakeholders for	Earmar groups Provide land for establishment of small scale	
scaling up and their roles	• Farmer groups – Frovide faild for establishment of small- scale cashew apple juice processing facility	
searing up and them roles	 Extension service providers - Help in the dissemination 	
	 KALRO – Train trainers and provide technical backstopping on 	
	dissemination of cashew apple juice production technology	
	• KEBS – Standards formulation for cashew apple juice.	
	certification of private apple juice processors	
	• Supermarkets, institutions and hotels - will provide markets for	
	the cashew apple juice	
C: Current situation and future	scaling up	
Counties where already	Kilifi	
promoted, if any		
Counties where TIMPs will	Kwale, Tana River and Lamu	
be up scaled	. Cashay and Ivias has tannin tasts which takes more time	
Chanenges in dissemination	• Cashew apple Juice has taninin taste which takes more time to come up the final product	
	• Limited processing technology at the household level	
	 Difficulty in acquiring certificates from regulatory 	
	authorities	
	• Lack of established standards for the product	
	• Limited consumer knowledge of value-added cashew apple	
Suggestions for addressing the	• Awareness creation about the product to farmers, consumers	
challenges	and other value chain actors	
_	• Capacity building of stakeholders on how to process the	

	product
	• Information dissemination – postharvest handling, value
	addition, and nutritional attributes of the product
	• Involvement of regulatory agencies and policy makers in up
	scaling process
	 Linkage to credit facility providers to promote
	commercialization
	A dyogoogy for standards development for value added cashow
	 Advocacy for standards development for value added cashew products: putrition advaction to consumers
	Cash and an la lating has tangin to the makes it not
Lessons learned in up scaling,	• Casnew apple Juice has tannin taste which makes it not
	acceptable by many clients
Social, environmental, policy	• Target women and youth as entrepreneurs in society who are
and market conditions	the major adopters (manufacturers) and consumers,
necessary for development and	respectively
up scaling	• There is need to develop quality standards for cashew apple
	juice to propel its commercialization
	• There is need for the government to facilitate affordable
	credit to empower farmers take up cashew juice agribusiness.
D: Economic, gender, vulnerab	e and marginalized groups (VMGs) considerations
Basic costs	Not yet determined
Estimated returns	Not yet determined
Gender issues and concerns in	• Women and youth have limited access to credit to purchase
development, dissemination	the required equipment
adoption and scaling up	• Women and youth have limited access to education, training
	and extension services
	• Women have limited access to markets than men
	• Women have less access to agricultural information,
	technology and knowledge
	• Men dominant most decisions at the household and community
	levels
Gender related opportunities	Women and youth stand to benefit in production, use and
	sale of cashew apple juice
VMG issues and concerns in	• VMGs have limited access to credit that can be used to purchase
development, dissemination	the required implement
adoption and scaling up	• VMGs have limited access to training and extension services
	• VMGs have limited access to markets as they sometimes cannot
	travel to far regional markets due to either their sickness,
	disability or lack of exposure
	• Due to their social status VMGs are often excluded from
	decision making in development and dissemination activities
	• VMGs have limited access to seed and information on new
	varieties and production techniques
	• There is low adoption by VMGs due lack of awareness
VMG related opportunities	• Opportunity for VMGs to produce, trade in, and consume
11	locally produced cashew apple juice.
	• Affirmative action opportunities such as the women and youth
	enterprise fund exist for VMGs to access the required credit to
	procure drum roasters and packaging materials, branding
	among others.

E: Case studies/profiles of success stories		
Success stories		
Application guidelines for users	 Cashew planting guide, KALRO Mtwapa Cashew for Cash booklet, KALRO Mtwapa KALRO Cashew Nut https://play.google.com/store/apps/details?id=com.andromo. dev724321.app928007 Cashew Nut Production, A reference handbook for farmers in Kenya, Muniu F.K. Website: www.kalro.org Ukuzaji Bora wa Mkorosho, Mwongozo wa Wakulima Nchini Kenya, Muniu F.K. 	
	6. Cashew apple juice production leaflets and manuals	
F: Status of TIMP readiness (1-Ready for upscaling, 2- requires validation, 3-requires further research)	2. Requires validation	
G: Contacts		
Contacts	Institute Director, KALRO –ICRI Mtwapa Kalro.Mtwapa@kalro.org	
Lead organization and scientists	KALRO: Wayua F., Ndambuki J.	
Partner organizations and contacts	Agricultural University Colleges, MoALF, NGOs, CBOs	

- 1. Fine-tuning the production protocol and packaging
- 2. Determining market demand and gross margins
- **3**. Characterize different cashew varieties for their nutritional composition and suitability for processing various value-added products (juice, jam, flour)
- 4. Determining the nutritional composition of the cashew apple juice

TIMP name	Cashew apple jam
Category (technology, innovation	Technology
or management	
A: Description of the technology i	nnovation or management practice
Problem addressed	• Limited utilization of cashew apple
i iobiciii addressed	 Inadequate knowledge on processing of cashew apples into
	value added products such as the jam.
	• Lack of awareness by farmers on the importance of cashew
	 apples High postharvest losses for cashew apple
What is it? (TIMP description)	Cashew apple jam is prepared from fresh ripe cashew apples. The
	apples are washed, peeled and then cut into small pieces and
Cashew Jam Source:	blended. The resultant pulp is then mixed with sugar/honey with
Internet	other flavoring compounds and heated to boiling point which is
	maintained at that temperature for 5 minutes. It is then cooled and
	prices and boosting household incomes
	Prices and coording nousenois incomes
	The processed cashew jam ready for the market
Justification	Diversification of cashew food products stands to enhance
	Currently, farmers throw away the cashew apple in the field after
	extracting the nut. In most cashew nut producing countries the
	cashew apple is the most valuable product compared to the nut
	since it can be processed into many value-added products among
	them the valuable jam. It is therefore necessary to train the cashew
	has been considered waste
B: Assessment of dissemination an	d scaling up/out approaches
Users of TIMP	Farmers, agripreneurs, traders, extension agents, small-scale
	processors, restaurants, industrial and commercial processors
Approaches to be used in	• Use of on-farm demos, exhibition during field days, farmer
dissemination	to farmer training and agricultural shows
	• Iviass media (1 v and radio programs, promotional materials leaflets, posters, brochures, manuals and pamphlets)

2.9.6 Cashew apple jam

	• Use of digital platforms comprising web materials, mobile
	telephone applications and short message services (SMS)
	Regular localized meetings
	• Farmer field and business Schools (FFBS)
	Agricultural Innovation Platforms (AIP)
	• Public and private agricultural extension services.
Critical/essential factors for	• Target women and youth as entrepreneurs in society
successful promotion	who are the major adopters (manufacturers) and
	consumers, respectively.
	• Establish the value addition cottage processing facilities
	near the sources of cashew nut to reduce on operational
	costs
	• Develop quality standards for cashew nut to propel its commercialization
	• Farmer groups may need to align their cottage processing
	facilities to existing government policies.
	Increased production of high-quality raw cashew nut
Partners/stakeholders for scaling	• Farmers – To increase the production of quality cashew
up and their roles	apples
	• Farmer groups – to provide land for establishment of
	small- scale cashew juice processing facility
	• Extension service providers - Help in the dissemination
	• KALRO – will train trainers and provide technical
	backstopping on dissemination of cashew apple jam
	production technology
	• KEBS – For standards formulation for cashew apple
	Jam, certification of private apple jam processors
	hospitals) to provide markets for the cashow jujee
	 National and County governments - to enact enabling policies
C: Current situation and future s	scaling up
Counties where already	None
promoted, if any	
Counties where TIMPs will be	Kwale, Kilifi and Lamu
upscaled	
Challenges in dissemination	• Limited awareness of the cashew jam product by farmers
	and local consumers
	• Limited processing technology at the household level
	 Difficulty in acquiring certificates from regulatory authorities
	• Lack of quality standards for the product currently
	• Limited consumer awareness of cashew apple value-
	added products
Suggestions for addressing the	• Awareness creation about the product to farmers,
challenges	consumers and other value chain actors.
	• Capacity building of farmers on how to prepare the
	product

	• Information dissemination – postharvest handling, value
	addition, and nutritional attributes of the product
	• Involvement of regulatory agencies and policy makers in
	up scaling process,
	• Linkage of processors to promote commercialization,
	• Advocacy for standards development for value added
	cashew products;
	• Sensitization of consumers on cashew apple jam nutrition
	benefits.
Lessons learned in up scaling,	• The need to have enough cashew apples for sustainable jam
if any	processing
	• Change of attitude by consumers to adopt cashew apple jam
	consumption.
Social, environmental, policy and	• Target women and youth as entrepreneurs in society who
market conditions necessary for	are the major adopters (manufacturers) and consumers,
development and up scaling	respectively
	• There is need to develop quality standards for cashew
	apple juice to propel its commercialization
	• There is need for the government to facilitate affordable credit to empower farmers take up cashew jujce agribusiness.
D: Economic, gender, vulnerable	and marginalized groups (VMGs) considerations
Basic costs	Not yet determined
Estimated returns	Not yet determined
Gender issues and concerns in	• Women and youth have limited access to credit to
development, dissemination	purchase the required equipment
adoption and scaling up	• Women and youth have limited access to education.
	training and extension services
	• Women have limited access to markets
	• Women have less access to agricultural information.
	technology and knowledge
	• Men dominant most decisions at the household and
	community levels
Gender related opportunities	• Women and youth stand to benefit in production, use and
	sale of cashew jam
VMG issues and concerns in	• VMGs have limited access to credit that can be used to
development, dissemination	purchase the required implement.
adoption and scaling up	• VMGs have limited access to training and extension
	services
	• VMGs have limited access to markets as they sometimes
	cannot travel to far regional markets due to either their
	sickness, disability or lack of exposure
	• Due to their social status VMGs are often excluded from
	decision making in development and dissemination
	activities
	• VMGs have limited access to seed and information on new
	varieties and production techniques
	• There is low adoption by VMGs due lack of awareness.

VMG related opportunities	Opportunity for VMGs to produce, trade in, and consume locally produced cashew jam
E: Case studies/profiles of success stories	
Success stories	 Cashew apple jam has been successfully processed and traded in other countries such as Brazil and Vietnam, thereby improving the livelihoods of the farmers.
Application guidelines for Users	Cashew jam production leaflets and manuals
F: Status of TIMP readiness (1- Ready for upscaling, 2- requires validation, 3-requires further research)	2. Requires validation
G: Contacts	
Contacts	Institute Director, KALRO –ICRI Mtwapa Kalro.Mtwapa@kalro.org
Lead organization and scientists	KALRO: Mwashumbe S., Muniu F.K., Pole F.N., Wayua F., Ndambuki J.
Partner organizations and contacts	Agricultural University Colleges, MoALF, NGOs, CBOs
CADS	

- 1. Characterizing the various cashew varieties for their apple jam production potential
- 2. Optimizing the jam production procedures
- 3. Providing data on gross margins and market demand for cashew jam production

2.9.7	Cashew	apple	wine

TIMP name	Cashew apple wine
Category (technology, innovation or management practice)	Technology Technology Technology Technology
A: Description of the technology	y, innovation or management practice
Problem addressed	 Limited utilization of cashew apple Inadequate knowledge on processing of cashew apples into value added products such as the wine. Lack of awareness by farmers on the importance of cashew apples

	High postharvest losses for cashew apple
What is it? (TIMP description)	 Cashew wine is made from ripe cashew apple through fermentation process. Additional ingredients in the process include wine yeast and sugar. Cashew apple wine is a high value product that can be obtained from the cashew tree.
	demand, thereby spurring increased products clinatices consumption and demand, thereby spurring increased production. Currently, Kenyan farmers throw away the cashew apple after extracting the nut. In most of the cashew nut producing countries, the cashew apple is the most valuable product compared to the nut since it can be processed into many value-added products including the wine thereby increasing the value of the cashew nut tree. The cashew stakeholders need to be trained on how to value-add the cashew apple to make the valuable cashew apple wine for both domestic use and sale locally and internationally.
B: Assessment of dissemination	and scaling up/out approaches
Users of TIMP	Farmers, agripreneurs, traders, extension agents, small-scale processors, entrepreneurs, restaurants, industrial and commercial processors
Approaches to be used in dissemination Critical/essential factors for successful promotion	 Use of on-farm demos, exhibition during field days, farmer to farmer training and agricultural shows Mass media (TV and radio programs, promotional materials leaflets, posters, brochures, manuals and pamphlets) Use of digital platforms comprising web materials, mobile telephone applications and short message services (SMS) Regular localized meetings Farmer field and business Schools (FFBS) Agricultural Innovation Platforms (AIP) Public and private agricultural extension services. Awareness creation to cashew stakeholders on the value of the cashew apple and its use in wine making. Stakeholder capacity building and establishment of networks to share knowledge on wine making Promotion of cashew apple wine making while embracing the Public Private Partnerships (PPP) approach. Increased production of high-quality cashew apples for processing into apple wine Development and availing quality standards for cashew apple wine
Partners/stakeholders for scaling up and their roles	 Farmers – To increase the production of quality cashew apples Farmer groups – Provide land for establishment of small-scale cashew juice processing facility Extension service providers (Public and private) to help in the dissemination KALRO – Train trainers and provide technical backstopping on dissemination of cashew apple wine production technology KEBS – For standards formulation for cashew apple

	wine, certification of private apple wine processors,
	supermarkets and institutions to provide markets for
	the cashew juice
	• National and County governments - to enact enabling
	policies
C: Current situation and future	scaling up
Counties where already promoted, if any	None at the moment
Counties where TIMPs will be upscaled	Kwale, Kilifi, Lamu
Challenges in dissemination	 Limited awareness of the cashew apple wine product by stakeholders Difficulty in acquiring certificates from regulatory authorities Lack of quality standards for the product Limited consumer awareness of cashew apple wine.
Suggestions for addressing the challenges	 Awareness creation about the product to cashew stakeholders. Capacity building of farmers and other value chain actors on how to prepare the product.
	 Information dissemination – postharvest handling, value addition, and nutritional attributes of the product Involvement of regulatory agencies and policy makers in up scaling process, Advocacy for standards development for value added cashew products;
Lessons learned in up scaling, if any	 The need to have enough cashew apples for sustainable wine processing Change of attitude by consumers to adopt cashew apple wine consumption.
Social, environmental, policy and market conditions necessary for development and up scaling	 Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers of the cashew apple value added products. There is need to develop quality standards for cashew wine to propel its commercialization Government may need to offer credit facilities to smallholder entrepreneurs so as they may start cottage processing of cashew apple wine for commercial purposes
D: Economic, gender, vulnerabl	e and marginalized groups (VMGs) considerations
Basic costs	Not yet determined
Estimated returns	Not yet determined
Gender issues and concerns in development, dissemination adoption and scaling up	 Women and youth have limited access to credit to purchase the required equipment Women and youth have limited access to education, training and extension services Women have limited access to markets Women have less access to agricultural information, technology and knowledge

	• Men dominant most decisions at the household and community levels
Gender related opportunities	• Women and youth stand to benefit in production, use and sale of cashew wine
VMG issues and concerns in development, dissemination adoption and scaling up	 VMGs have limited access to credit that can be used to purchase the required implement VMGs have limited access to training and extension services VMGs have limited access to markets as they sometimes cannot travel to far regional markets due to either their sickness, disability or lack of exposure Due to their social status VMGs are often excluded from decision making in development and dissemination activities VMGs have limited access to seed and information on new varieties and production techniques There is low adoption by VMGs due lack of awareness
VMG related opportunities	• The technology offers a good opportunity for VMGs to produce, trade in, and consume locally produced cashew wine
E: Case studies/profiles of success stories	
Success stories	 Cashew apple wine has been successfully processed and traded in other countries such as Brazil and Vietnam, thereby improving the livelihoods of the farmers.
Application guidelines for Users	 Cashew Nut Processing manual – the basics <u>https://www.unido.org/sites/default/files/2013-</u>7/Cashew_nuts_final_presentation_PP_0.pdf Handbook of processing of cashew nuts, A.A.T. Manirbhar Bharat, Indian Institute of Food Processing Technology Ministry of Food Processing Industries, Government of India, Pudukkottai Road, Thanjavur Tamil Nadu http://www.niftem-t.ac.in/pmfme/cnutscurmet.pdf
F: Status of TIMP readiness (1-Ready for upscaling, 2- requires validation, 3-requires further research)	2 Requires validation
G: Contacts	
Contacts	Institute Director, KALRO –ICRI Mtwapa Kalro.Mtwapa@kalro.org
Lead organization and scientists	KALRO: Mwashumbe S., Muniu F.K., Pole F.N., Wayua, J. Ndambuki F.
Partner organizations and contacts	Agricultural University Colleges, MoALD, NGOs, CBOs

- 1. Characterizing the various cashew varieties for their wine production potential (for example, which variety produces the best wine)
- 2. Optimizing the wine production procedures
- 3. Providing data on gross margins and market demand for cashew wine production

TIMP name	Cashew Apple Flour
Category (technology, innovation or management practice)	Innovation Innovation Cashew apple flour
A: Description of the technology, innovation or management practice	
Problem addressed	 Limited utilization of cashew apple Inadequate knowledge on processing of cashew apples into value added products such as the flour. Lack of awareness by farmers on the importance of cashew apples High postharvest losses for cashew apple Over dependence on maize and wheat as the main source of flour
What is it? (TIMP	Flour can also be made from dried and milled cashew apple. The
description)	cashew apples are normally sorted, washed, sliced and dried at 65 ^o C. Thereafter, it is milled to produce cashew apple powder (CAP). The CAP can be used for whole wheat flour substitution to produce composite flours in different ratios to process various food products.
Justification	Diversification of cashew food products enhances consumption and demand, thereby spurring increased production. Farmers discard the cashew apple in the field after extracting the nut. In most of the cashew nut producing countries in the world, the cashew apple is the most valuable product compared to the nut since it can be processed into many values added products including the high value cashew apple flour thus. For this reason cashew farmers are starting to process cashew apples into flour for blending with wheat flour.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, agriprenuers, traders, extension agents, aggregators, industrial and commercial processors
Approaches to be used in dissemination	 Use of on-farm demos, exhibition during field days, farmer to farmer training and agricultural shows Mass media (TV and radio programs, promotional materials leaflets, posters, brochures, manuals and pamphlets) Use of digital platforms comprising web materials, mobile telephone applications and short message services (SMS) Regular localized meetings Farmer field and business Schools (FFBS) Agricultural Innovation Platforms (AIP) Public and private agricultural extension services.

2.9.8 Cashew Apple Flour
	• Awareness creation to various stakeholders on the value of
successful promotion	the cashew apple in flour making.
1	• Stakeholder capacity building in processing of cashew
	apple into flour.
	• Promotion of flour processing while embracing the Public
	Private Partnerships (PPP) approach.
	• Increased production of high-quality cashew apples for
	processing into flour
	 Development and availing quality standards for cashew apple
	flour
Partners/stakeholders for	• Farmers – To increase the production of quality cashew
scaling up and their roles	apples
	• Farmer groups – Provide land for establishment of small-
	scale cashew flour processing facility
	• Extension service providers - Help in the dissemination
	• KALRO – Train trainers and provide technical
	backstopping on dissemination of cashew apple flour
	production technology
	• KEBS – For standards formulation for cashew apple flour,
	and institutions to provide markets National and County
	governments - to enact enabling policies
C: Current situation and future	re scaling up
Counties where already	None
promoted, if any	
Counties where TIMPs will	Kwale, Kilifi and Lamu
be upscaled	
Challenges in dissemination	• Limited awareness of the cashew flour product by farmers
	and consumers
	 Limited processing technology at the household level
	 and consumers Limited processing technology at the household level Difficulty in acquiring certificates from regulatory
	 and consumers Limited processing technology at the household level Difficulty in acquiring certificates from regulatory authorities
	 and consumers Limited processing technology at the household level Difficulty in acquiring certificates from regulatory authorities Lack of quality standards for the product
	 and consumers Limited processing technology at the household level Difficulty in acquiring certificates from regulatory authorities Lack of quality standards for the product Lack of credit facilities for processors
	 and consumers Limited processing technology at the household level Difficulty in acquiring certificates from regulatory authorities Lack of quality standards for the product Lack of credit facilities for processors Limited consumer awareness of cashew apple value-
	 and consumers Limited processing technology at the household level Difficulty in acquiring certificates from regulatory authorities Lack of quality standards for the product Lack of credit facilities for processors Limited consumer awareness of cashew apple value-added products
Suggestions for addressing the	 and consumers Limited processing technology at the household level Difficulty in acquiring certificates from regulatory authorities Lack of quality standards for the product Lack of credit facilities for processors Limited consumer awareness of cashew apple value-added products.
Suggestions for addressing the challenges	 and consumers Limited processing technology at the household level Difficulty in acquiring certificates from regulatory authorities Lack of quality standards for the product Lack of credit facilities for processors Limited consumer awareness of cashew apple value-added products. Awareness creation about the cashew flour to farmers, consumers and other value chain actors
Suggestions for addressing the challenges	 and consumers Limited processing technology at the household level Difficulty in acquiring certificates from regulatory authorities Lack of quality standards for the product Lack of credit facilities for processors Limited consumer awareness of cashew apple value-added products. Awareness creation about the cashew flour to farmers, consumers and other value chain actors. Capacity building of farmers on how to prepare the product
Suggestions for addressing the challenges	 and consumers Limited processing technology at the household level Difficulty in acquiring certificates from regulatory authorities Lack of quality standards for the product Lack of credit facilities for processors Limited consumer awareness of cashew apple value-added products. Awareness creation about the cashew flour to farmers, consumers and other value chain actors. Capacity building of farmers on how to prepare the product Information dissemination – postherwest handling value
Suggestions for addressing the challenges	 and consumers Limited processing technology at the household level Difficulty in acquiring certificates from regulatory authorities Lack of quality standards for the product Lack of credit facilities for processors Limited consumer awareness of cashew apple value-added products. Awareness creation about the cashew flour to farmers, consumers and other value chain actors. Capacity building of farmers on how to prepare the product Information dissemination – postharvest handling, value addition and nutritional attributes of the flour
Suggestions for addressing the challenges	 and consumers Limited processing technology at the household level Difficulty in acquiring certificates from regulatory authorities Lack of quality standards for the product Lack of credit facilities for processors Limited consumer awareness of cashew apple value-added products. Awareness creation about the cashew flour to farmers, consumers and other value chain actors. Capacity building of farmers on how to prepare the product Information dissemination – postharvest handling, value addition, and nutritional attributes of the flour Involvement of regulatory agencies and policy makers in
Suggestions for addressing the challenges	 and consumers Limited processing technology at the household level Difficulty in acquiring certificates from regulatory authorities Lack of quality standards for the product Lack of credit facilities for processors Limited consumer awareness of cashew apple value-added products. Awareness creation about the cashew flour to farmers, consumers and other value chain actors. Capacity building of farmers on how to prepare the product Information dissemination – postharvest handling, value addition, and nutritional attributes of the flour Involvement of regulatory agencies and policy makers in up scaling process
Suggestions for addressing the challenges	 and consumers Limited processing technology at the household level Difficulty in acquiring certificates from regulatory authorities Lack of quality standards for the product Lack of credit facilities for processors Limited consumer awareness of cashew apple value-added products. Awareness creation about the cashew flour to farmers, consumers and other value chain actors. Capacity building of farmers on how to prepare the product Information dissemination – postharvest handling, value addition, and nutritional attributes of the flour Involvement of regulatory agencies and policy makers in up scaling process Linkage processors to credit facility providers to promote
Suggestions for addressing the challenges	 and consumers Limited processing technology at the household level Difficulty in acquiring certificates from regulatory authorities Lack of quality standards for the product Lack of credit facilities for processors Limited consumer awareness of cashew apple value-added products. Awareness creation about the cashew flour to farmers, consumers and other value chain actors. Capacity building of farmers on how to prepare the product Information dissemination – postharvest handling, value addition, and nutritional attributes of the flour Involvement of regulatory agencies and policy makers in up scaling process Linkage processors to credit facility providers to promote commercialization
Suggestions for addressing the challenges	 and consumers Limited processing technology at the household level Difficulty in acquiring certificates from regulatory authorities Lack of quality standards for the product Lack of credit facilities for processors Limited consumer awareness of cashew apple value-added products. Awareness creation about the cashew flour to farmers, consumers and other value chain actors. Capacity building of farmers on how to prepare the product Information dissemination – postharvest handling, value addition, and nutritional attributes of the flour Involvement of regulatory agencies and policy makers in up scaling process Linkage processors to credit facility providers to promote commercialization Advocacy for standards development for value added

	• Sensitization of consumers on cashew apple flour nutrition benefits
Lessons learned in up scaling, if any	 The need to have enough cashew apples for sustainable flour processing Change of attitude by consumers to adopt cashew apple flour consumption.
Social, environmental, policy and market conditions necessary for development and up scaling D: Economic, gender, vulnera	 Target women and youth as entrepreneurs in society who are the major adopters (manufacturers) and consumers of the cashew apple value-added products. There is need to develop quality standards for the flour to propel its commercialization There's need for the government offer credit facilities to smallholder entrepreneurs so as they may start cottage processing of cashew apple flour for commercial purposes ble and marginalized groups (VMGs) considerations
Basic costs	Not yet
Estimated returns	Not yet
Gender issues and concerns in development, dissemination adoption and scaling up	 Women and youth have limited access to credit to purchase the required equipment Women and youth have limited access to education, training and extension services Women have limited access to markets Women have less access to agricultural information, technology and knowledge Men dominant most decisions at the household and at community levels
Gender related opportunities	• Women and youth stand to benefit in production, use and sale of cashew apple flour
VMG issues and concerns in development, dissemination adoption and scaling up	 VMGs have limited access to credit that can be used to purchase the required implement VMGs have limited access to training and extension services VMGs have limited access to markets as they sometimes cannot travel to far regional markets due to either their sickness, disability or lack of exposure Due to their social status VMGs are often excluded from decision making in development and dissemination activities VMGs have limited access to seed and information on new varieties and production techniques There is low adoption by VMGs due lack of awareness
VMG related opportunities	• Opportunity exists for VMGs to produce, trade in, and consume locally produced cashey apple flour
E: Case studies/profiles of suc	cess stories
Success stories	• Cashew apple flour has been successfully processed and traded in other countries such as Brazil and Vietnam, thereby improving the livelihoods of the farmers.
Application guidelines for users	Cashew apple flour production leaflets and manuals
F: Status of TIMP readiness	2. Requires validation

(1-Ready for upscaling, 2-	
requires validation, 3-requires	
further research)	
G: Contacts	
Contacts	Institute Director, KALRO –ICRI Mtwapa
	Kalro.Mtwapa@kalro.org
Lead organization and	KALRO: S. Mwashumbe, F.K. Muniu, F.N. Pole, F. Wayua, J.
scientists	Ndambuki
Partner organizations and	JKUAT, Pwani University, info@pu.ac.ke, MoALD
contacts	

GAPS

- 1. Characterizing the various cashew varieties for their cashew apple flour yield production potential
- 2. Research on flour conversion ratio (Cashew apple flour conversion ratio)
- 3. Research on nutritional content of cashew flour and the derived value-added cashew flourbased products
- 4. Research on technological and food processing properties of cashew apple flour (water absorption capacity, rheological properties, pasting characteristics, among others.)
- 5. Conduct business and economic analyses of cashew flour production and target markets for cashew flour
- 6. Research on options for commercializing the product linking with industry / off- takers (food processors, hotels, supermarkets, among others).
- 7. Development of quality standards for cashew flour and cashew flour-based products

TIMP Name	Processing cashew apple into pulp
Category (technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	There has been limited utilization of cashew apple in the food industry. Pulping cashew apples has not been explored locally.
What is it? (TIMP description)	Pulping is the extraction of pulp from cashew apple and its preservation for consumption.
Justification	Cashew apple is a product in the cashew value chain that can easily be value added through processing into pulp. However, the apple has been underutilized and it is often regarded as waste.
B: Assessment of dissemination and	scaling up/out approaches
Users of TIMP	Farmers, agriprenuers, traders, cottage processors, retail shops and supermarkets, extension service, NGOs, private service providers, micro-finance institutions
Approaches used in dissemination	 Use of on-farm demos, exhibition during field days, farmer to farmer training and agricultural shows Mass media (TV and radio programs, promotional materials leaflets, posters, brochures, manuals and pamphlets)

2.9.9 Processing cashew apple into pulp

Critical/essential factors for successful promotion	 Use of digital platforms comprising web materials, mobile telephone applications and short message services (SMS) Regular localized meetings Farmer field and business Schools (FFBS) Agricultural Innovation Platforms (AIP) Public and private agricultural extension services. Availability of skilled pulp processors Availability of pulping equipment Availability of good quality cashew apples Training in food safety
Partners/stakeholders for scaling up and their respective roles.	 Farmers – To increase the production of quality cashew apples Farmer groups – Provide land for establishment of small- scale cashew apple pulping processing facility Extension service providers - Help in the dissemination KALRO – Train trainers and provide technical backstopping on dissemination of cashew apple pulp production technology KEBS - For standards formulation for cashew apple pulp National and county governments - to enact enabling policies.
Counties where already promoted. if	Kilifi, Kwale.
any Counties where TIMPs will be upscaled	Lamu
Challenges in development and dissemination	• Lack of skills and equipment
Suggestions for addressing the challenges	 Training of women and youth groups in processing Provision of suitable financial facilities for processing Encourage more participation of NGOs/private partnerships in promoting local processing
Lessons learned in up scaling, if any	 Poor hygiene in processing, packaging and handling needs to be addressed
Social, environmental, policy and market conditions necessary for development and up- Scaling	 Cashew farmers must collect and sell the cashew apples to processors and traders The traders and processors need to coordinate collection of the cashew apple to ensure it does not spoil while with farmers Use of appropriate packaging materials
	• National and counter governments enabling policies that favour agriprocessing industries.
D: Economic, gender, vulnerable an	d marginalized groups (VMGs) considerations

Basic costs	To be determined
Estimated returns	To be determined
Gender issues and concerns in development, dissemination, adoption and scaling up	 Women and youth have limited access to credit to purchase the cashew apple in pulp equipment Women and youth have limited access to education, training and extension services Men dominants decisions on cashew at the household and community.
Gender related opportunities	 Employment opportunities exist for women in cashew pulp industry
VMG issues and concerns in development, dissemination, adoption and scaling up	 VMGs have limited access to credit to purchase the cashew apple in pulp equipment VMGs have limited access to education, training and extension services There is low adoption by VMGs due lack of awareness
VMG related opportunities	• Employment opportunities exist for VMGs in cashew
E: Case studies/profiles of success st	tories
Success stories	
Application guidelines for users	 Cashew Nut Processing manual – the basics <u>https://www.unido.org/sites/default/files/2013-07/Cashew_nuts_final_presentation_PP_0.pdf</u> Handbook of processing of cashew nuts, A.A.T. Manirbhar Bharat, Indian Institute of Food Processing Technology Ministry of Food Processing Industries, Government of India, Pudukkottai Road, Thanjavur Tamil Nadu http://www.niftem-t.ac.in/pmfme/cnutscurmet.pdf
Application guidelines for users F: Status of TIMP Readiness (1.	 Cashew Nut Processing manual – the basics <u>https://www.unido.org/sites/default/files/2013-07/Cashew_nuts_final_presentation_PP_0.pdf</u> Handbook of processing of cashew nuts, A.A.T. Manirbhar Bharat, Indian Institute of Food Processing Technology Ministry of Food Processing Industries, Government of India, Pudukkottai Road, Thanjavur Tamil Nadu http://www.niftem-t.ac.in/pmfme/cnutscurmet.pdf Requires validation
Application guidelines for users F: Status of TIMP Readiness (1. Ready for up scaling; 2. validation; 3. Requires further research) G: Contacts	 Cashew Nut Processing manual – the basics <u>https://www.unido.org/sites/default/files/2013-07/Cashew_nuts_final_presentation_PP_0.pdf</u> Handbook of processing of cashew nuts, A.A.T. Manirbhar Bharat, Indian Institute of Food Processing Technology Ministry of Food Processing Industries, Government of India, Pudukkottai Road, Thanjavur Tamil Nadu http://www.niftem-t.ac.in/pmfme/cnutscurmet.pdf Requires validation
Application guidelines for users F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research) G: Contacts	 Cashew Nut Processing manual – the basics <u>https://www.unido.org/sites/default/files/2013-07/Cashew_nuts_final_presentation_PP_0.pdf</u> Handbook of processing of cashew nuts, A.A.T. Manirbhar Bharat, Indian Institute of Food Processing Technology Ministry of Food Processing Industries, Government of India, Pudukkottai Road, Thanjavur Tamil Nadu http://www.niftem-t.ac.in/pmfme/cnutscurmet.pdf Requires validation
Application guidelines for users F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Further research) G: Contacts Contacts	 Cashew Nut Processing manual – the basics <u>https://www.unido.org/sites/default/files/2013-07/Cashew_nuts_final_presentation_PP_0.pdf</u> Handbook of processing of cashew nuts, A.A.T. Manirbhar Bharat, Indian Institute of Food Processing Technology Ministry of Food Processing Industries, Government of India, Pudukkottai Road, Thanjavur Tamil Nadu <u>http://www.niftem-t.ac.in/pmfme/cnutscurmet.pdf</u> Requires validation
Application guidelines for users F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research) G: Contacts Contacts Lead organization and scientists	 Cashew Nut Processing manual – the basics https://www.unido.org/sites/default/files/2013- 07/Cashew_nuts_final_presentation_PP_0.pdf Handbook of processing of cashew nuts, A.A.T. Manirbhar Bharat, Indian Institute of Food Processing Technology Ministry of Food Processing Industries, Government of India, Pudukkottai Road, Thanjavur Tamil Nadu http://www.niftem-t.ac.in/pmfme/cnutscurmet.pdf Requires validation Institute Director, KALRO –ICRI Mtwapa Kalro.Mtwapa@kalro.org KALRO, Mtwapa: Muniu F., Menza M., Mwashumbe S. and Pole F.

GAPS

- 1. Adoption of food safety standards in processing of cashew apple into pulp
- 2. Validation of appropriate cashew pulping techniques
- 3. Further research in cashew varieties and growing environment on pulp quality
- 4. Nutritional quality analyses

2.10 Food Safety Management System

TIMPs name	Good Agricultural Practices (GAP) for Cashew Value Chain in Kenya
Category (technology, innovation or management	Management practice
A: Description of the technology,	innovation or management practice
Problem addressed	Food safety has gained increased importance over the years because of its implications to health and trade. The consumer has increasingly become aware of the possibility of harm from food aided by technological advancements in the detection of biological and physical contaminants in food. The increased trade from demand for more food with the increased global population has also led to unscrupulous growers and traders using unsafe methods in production and in the other value chain processes. This not only results in unsafe low quality food but also unsustainable production systems through the misuse of resources such as land, water, manure, fertilizers, crop protection products among others. In addition, there have been concerns about the impact of crop production to environment, worker safety and produce traceability to ensure food safety and good ethical practices, both in the domestic and export market.
	Implementing Good Agricultural Practices (GAP) during on-farm production and post-production processes resulting in safe agricultural products is of immense importance for ensuring a safe food supply system globally
What is it? (TIMP description)	The four 'pillars' of GAP (economic viability, environmental sustainability, social acceptability and food safety and quality) are included in most private and public sector standards, but the scope which they actually cover varies widely. It is a systematic process of implementing a standardized production system globally designed to reassure consumers about how food is produced on the farm, pre-farm gate or on-farm standards. It is not about a specific crop production but the process through which production takes.
JUSUIICAUOII	Accent studies have shown that in Kenya, increased consumption and movement of crop produce has led to increased incidences of food borne illnesses. The evolving food industry and changes in consumer food preferences, feeding habits and practices has increased the volume of crops produce, leading to increased complexity in the distribution systems, thereby increasing the opportunities for exposure to contamination. Additionally, increased global trade and consumer demand for pre packed food for convenience has increased the potential for microorganisms' multiplication and the risk of exposure of diseases to the consumers. Changing social demographics in Kenya with the increase in the number of the elderly, children, pregnant women and immune compromised persons has also led

2.10.1 Good Agricultural Practices (GAP) for Cashew Value Chain in Kenya

	to a likely exposure to food borne hazards for the vulnerable
	Good Agricultural Practices (GAP) is based on the principals of
	risk prevention risk analysis sustainable agriculture (by means
	of Integrated Pest Management (IPM) and Integrated Crop
	Management (ICM) to continuously improve forming systems
	There is need for reinforcement through transport open systems.
	free the form to the table including all invests (including
	from the farm to the table, including all inputs (including
	fertilizers, plant protection products, water and soil) and all value
	chain players including providers of logistics and equipment's.
B: Assessment of dissemination a	nd scaling up/out approaches
Users of TIMP	All cashew value chain players including producers, extension
	staff, processors, transporters and market outlet operators
	including wholesale and retail chains, domestic markets and
	farm gate handlers
Approaches to be used in	• Farmer Field and Business School (FFBS)
dissemination	Agricultural innovation platforms (AIP)
	 Demonstrations - On-farm and on station
	 Agricultural shows/exhibitions/field days
	• Trainings - workshops/Seminars/Meetings
	Public and private Extension Agents
	• Farmer to farmer extension models
	• Mass media – Electronic and print
	• Publications -posters/brochures/leaflets, manuals
	• Digital Platforms- Website, Dashboards, Apps, social
	media short message services
Critical/essential factors for	Policy support from government particularly the enforcement of
successful promotion	KS1758 fresh produce domestic scope standard and it passing the
-	current public participation stage.
Partners/stakeholders for scaling	1. Producerorganizations - satisfy production requirement
up and their roles	2. NGO's – funding and dissemination of practices
	3. MoALD - Extension services and regulation of on farm
	demonstration
	4. Private extension providers – buyers of cashew
	production
	5. PrCoG and other value chain players – support and promote
	the policy
C: Current situation and future s	caling up
Counties where already	None
promoted, if any	
Counties where TIMP will be up	Lamu, Kilifi, Kwale
scaled	
Challenges in dissemination	• Lack/inadequate knowledge on the benefits GAPS
	• Lack of legislative mechanisms to support the GAP, in
	particular the domestic scope
	• The perception that GAP is oppressive rather than
	supportive
Recommendations for addressing	• Continuous training of farmers, extension staff and
the challenges	other value chain players.
-	• Mechanisms to support the GAP in domestic scope.

ally	The low humber of stakeholders aware of Gra	
Social environmental policy and	Supportive policy of national and county governments to	
market conditions necessary	promote adaption of GAP's.	
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations		
Basic costs	To be determined	
Estimated returns	To be determined	
Gender issues and concerns in	Most small-scale production systems are centered on women and	
development, dissemination	hence they suffer from the detriments of poor processes; for	
adoption and scaling up,	example improper application of pesticides results in more	
	women suffering from complications than the men in small-scale	
	holdings. This means that adaption of GAPS will increase the	
	benefits of good health in women and those who work more on	
	the farm.	
Gender related opportunities	Job opportunity for unskilled women and youth due to systematic method of the processes	
VMG issues and concerns in	• Requires a lot of movement on the farm to maintain	
development, dissemination,	records and processes verification	
adoption and scaling up	• Unfriendly dissemination methods and documents,	
	illiteracy, poverty, market access problems	
VMG related opportunities	There will be enhanced productivity of smaller parcels of land	
	to the advantage of youth who normally have no access to	
	larger parcels.	
E: Case studies/profiles of success	s stories	
Success stories from previous similar projects	None	
Application guidelines for users	KS 1758 Horticulture Code of Practice	
F: Status of TIMP readiness (1.	1. Ready for up scaling	
Ready for upscaling; 2. Requires		
validation; 3. Requires further		
research)		
G: Contacts		
Contacts	Officer in Charge	
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	2. Centre Directors; KALRO FCRI Njoro -	
	Kairo.njoro@kairo.org.	
	4 Director General KALRO Director@kalro.org	
Lead organization and scientists	KALRO: Nyaga, A., Ndung'u, J., Wayua, F., Muniu, F.K.	
	Mwashumbe, S.K., Wasilwa, L and Kirigua, V.	
Partner organizations and	1. MoALD - Extension services and regulation of on farm	
i artifer organizations and		
contacts and their roles	demonstration. info@kilimo.go.ke	
contacts and their roles	2. AFA – info@afa.go.ke	
contacts and their roles	 demonstration. info@kilimo.go.ke 2. AFA - info@afa.go.ke 3. FPEAK interpretation and harmonization of standards 	
contacts and their roles	 demonstration. info@kilimo.go.ke 2. AFA - info@afa.go.ke 3. FPEAK interpretation and harmonization of standards .info@fpeak.org 	
contacts and their roles	 demonstration. info@kilimo.go.ke 2. AFA - info@afa.go.ke 3. FPEAK interpretation and harmonization of standards .info@fpeak.org 4. PCPB - monitor the quality of pest control products almodulin the module linfo@peak.org 	
contacts and their roles	 AFA - info@afa.go.ke AFA - info@afa.go.ke FPEAK interpretation and harmonization of standards .info@fpeak.org PCPB - monitor the quality of pest control products already in the market. info@pcpb.go.ke AAK _ distributors of past control products 	
research) G: Contacts Contacts Lead organization and scientists Partner organizations and	 Officer in Charge 1. KALRO – PTC, - info.ptc@kalro.org 2. Centre Directors; KALRO FCRI Njoro - kalro.njoro@kalro.org. 3. KALRO Mtwapa; kalro.mtwapa@kalro.org 4. Director General KALRO.Director@kalro.org KALRO: Nyaga, A., Ndung'u, J., Wayua, F., Muniu, F.K., Mwashumbe, S.K., Wasilwa, L and Kirigua, V. 1. MoALD - Extension services and regulation of on farm 	

6. KEPHIS - Phytosanitary regulation and patenting of
materials. kephisinfo@kephis.org
7. CoG – support and promote policy in counties
8. NGO's and Universities – dissemination of practices

2.10.2 Food Safety Management System: Hazard Analysis Critical Control Points (HACCP) Plan for Cashew Value Chain in Kenya

TIMP Name	Food Safety Management System: Hazard Analysis Critical Control Points (HACCP) Plan for Cashew Value Chain in Kenya
Category (technology, innovation or management practice)	Management Practice
A: Description of the technology,	innovation or management practice
Problem addressed	The presence of chemicals and biological hazards in the cashew value chain in Kenya have a direct effect on consumer's health thereby constantly increasing demand for high quality of the crop and it's by products from consumers and public health departments in counties. These hazards have direct economic consequences affecting families, communities and industries subsisting on the cashew value chain in Kenya. This ultimately leads to reduced productivity of the active population in the country. Biological contaminations reported on this value chain include presence of <i>Escherichia coli</i> (E. coli), <i>Salmonella spp., Aspergillus flavus</i> and <i>Aspergillus parasiticus</i> . The chemical hazards due to mycotoxins, heavy metal contaminations and uncontrolled pesticide use have previously been detected which has been attributed to neurological disorders, on set of cancer and birth defects to the consumers.
What is it? (TIMP description)	Food safety management system (FSMS) through Hazard Analysis and Critical Control Point (HACCP) in cashew is a system of food safety monitoring and control based on the systematic identification and assessment of various hazards. It is a preventive, rather than a reactive, tool that places the protection of the cashew products supply from biological, chemical and physical hazards into the hands of food management systems. The HACCP system is designed to minimize the risk of food safety hazards by identifying the hazards, establishing controls and monitoring these controls. When this HACCP concept is applied to the management of likely adverse health effects resulting from exposure to hazards in the cashew value chain, a wholesome and safe cashew products supply can be maintained improving on trade and health within and without Kenya borders.
Justification	The only important tool kit to assure food safety through monitoring in the cashew value chain is the Hazard Analysis and Critical Control Points (HACCP) system. This critical tool is already incorporated into the Codex Alimentarius of the world as well as into the national public health food safety legislations of Kenya. This HACCP approach can be applied to all stages of the cashew value chain process, ranging from production to

	processing, transportation, retail in commercial establishments
	and/or direct utilization by the consumer. Through its application
	food safety charts in the cashew value chain will easily be
	identified through critical control points. This will set limitation
	values for monitoring so that action can be taken if the set point
	values for momenting so that action can be taken if the set point
	values of nazards are out of the defined range required. In this
	cashew value chain, the proposed FSMIS that will be adopted,
	hazards would be minimized in every phase of production,
	harvesting, processing, distribution and consumption making
	cashew products safe for consumption by Kenyans. The key
	elements that will be used or modified to reduce hazards
	formation in all steps of production to consumption will be
	identified.
B: Assessment of dissemination a	and scaling up/out approaches
Users of TIMP	Cashew value chain actors from farmers, traders, agripreneurs,
	food vendors and consumers.
Approaches used in	• Farmer Field and Business School (FFBS)
dissemination	Agricultural innovation platforms (AIP)
	• Demonstrations – On-farm and on station
	Agricultural shows/exhibitions/field days
	• Trainings - workshops/Seminars/Meetings
	Public and private Extension Agents
	• Farmer to farmer extension models
	Mass media – Electronic and print
	Publications - posters/brochures/leaflets, manuals
	• Digital platforms – Website, Dashboards, Apps, Social media
	short message services
Critical/essential factors for	For successful promotion of food safety management system
successful promotion	through HACCP in the cashew value chain;
	• An expert team comprising a HACCP specialist, food
	scientist, microbiologist, representative of the cashew
	growers, public health officer, and a quality control and safety
	specialist from the Kenya Bureau of Standards will be
	formulated.
	• Distribution of the printed HACCP plan to cashew value chain
	actors for implementation in order to reduce hazards.
Partners/stakeholders for scaling	Institutions with IPM and ICM programs
up and their respective roles.	• Institutions responsible for legislating in food safety,
	regulations and sale of pesticides
	• Institutions with the required analytical testing
	• Training institutions with extension programs to producers
	and other actors on the chain
	• Producers and exporters associations buying cashew from
	tarmers
	• County extension staff - training famers of food safety
	• Universities (Public and Private) – training programs and
	 NOUS – capacity building Processors and local trader – purchasing and processing the cashew
C. Current situation and future	purchasing and processing the cashew
$_{\rm I}$ \sim , \sim urrent productor and ruture p	

Counties where already Promoted if any	Kilifi, Kwale, Muranga, Kiambu, Meru	
Counties where TIMPs will be up scaled	Lamu, Kwale, Kilifi	
Challenges in development and dissemination	Inadequate funds to reach value chain actors	
Suggestions for addressing the challenges	Funding of dissemination platforms	
Lessons learned in up scaling, if any	The value chain of cashew nut in Kenya is willing to adopt the HACCP plan if well engaged.	
Social, environmental, policy and market conditions necessary for development and up-scaling	The policies and laws in public health in place in Kenya are supportive to the use of HACCP Plan in cashew value chain.	
D: Economic, gender, vul	nerable and marginalized groups (VMGs) considerations	
Basic costs	To be determined	
Estimated returns	To be determined	
Gender issues and concerns in development, dissemination, adoption and scaling up	 Women have high levels of illiteracy than men, hence are not educated enough to read the GAP Women have less access to agricultural information, technology and knowledge than men Men dominant decisions at the household and national levels 	
Gender related opportunities	• Employment opportunities exist for youth in cotton production and marketing through ICT	
VMG issues and concerns in development, dissemination, adoption and scaling up	 The elderly have high levels of illiteracy than men, hence are not educated enough to the GAP VMGs have less access to agricultural information, technology and knowledge Due to their social status VMGs are often excluded from decision making in development and dissemination activities There is low adoption by VMGs due lack of awareness 	
VMG related opportunities	• Opportunities exist for unemployed youth in cotton production and marketing through ICT	
E: Case studies/profiles of success	s stories	
Success stories from previous similar projects	Cashew processors have successfully applied for export market	
Application guidelines for users	HACCP plan for Cashew	
• F: Status of TIMP Readiness		
TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	1. Ready for up scaling	
G: Contacts		
Contacts	The Institute Director, KALRO – ICRI director icri@kalro.org	
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4.	PCPB - info@pcpb.go.ke
5.	AAK - info@aakgrow.com
6.	KEPHIS - kephisinfo@kephis.org
7.	County governments,
8.	NGO's
9.	Universities

GAPS

- Software for running the budgets
- Profitable opportunities

2.11 Mechanization of Cashew Production Activities

TIMP Name	Power Tiller
Category (i.e. technology, innovation or management practice)	
A: Description of the technolog	y, innovation or management practice
Problem to be addressed	 Slow and tedious processes of seedbed preparation in a commercialized cashew farm Difficult to prepare a uniform fine tilled seedbed manually Delayed operation leading to late planting Drudgery leads to low acreage High cost of manual labour
What is it? (TIMP description)	It is a low powered two-wheeled agricultural implement with an 8- 16hp that can be attached to implements such as a rotary tiller, disk harrow, mouldboard plough, trailer, chisel or water pump at alternate times for easing farm operations. Also referred to as a walking tractor. It can complete one hectare in two hours per operator when ploughing. This varies depending on the climatic conditions, soil types, soil moisture content, operator stamina and experience. Fuel

2.11.1 Power Tiller

	consumption is about 15 litres per ha. Though these results may vary
	with the technical ability or aptitude of the operator.
Justification	It has multiple uses when coupled with other equipment such as
	seedbed preparation, sowing seed, spraying of fertilizer or herbicide
	and even irrigation. In addition, it can also be used for threshing and
	transporting produce. A power Tiller is ideal where the land size is
	small. Farm sizes less than one hectare may limit maneuverability of
	conventional tractors and manual Labour is slow costly and
	unsustainable.
B: Assessment of dissemination	and scaling up/out approaches
Users of the TIMP	• Cashew farmers, agripreneurs, extension staffs, Universities
	and researchers
Approaches used in	• Use of on-farm demos, exhibition during field days, farmer to
dissemination	farmer training and agricultural shows
	• Mass media (TV and radio programs, promotional materials
	leaflets, posters, brochures, manuals and pamphlets)
	• Use of digital platforms comprising web materials, mobile
	telephone applications and short message services (SMS)
	Regular localized meetings
	• Farmer field and business Schools (FFBS)
	Agricultural Innovation Platforms (AIP)
	•
Critical/essential factors for	• Applied and adaptive research to test and validate usage of the
successful promotion	power tiller.
	• A platform for interaction of Cashew value chain stakeholders
	 Multiple usage, timeliness, efficiency and low cost
Partners/stakeholders for	KALRO -
scaling up and their roles	Universities (for information) -
	Machinery fabricators -
	NGO supporting farmers for dissemination
C: Current situation and futur	e scaling up
Counties where the TIMP is	None
already promoted if any	
Counties where TIMP will be	Kilifi, Kwale, Lamu and Tana River
up scaled	
Challenges in dissemination	• Lack of cashew innovation platforms to facilitate interaction of
	farmers with relevant stakeholders
	Lack of machines
	Lack of demonstration sites
	High initial cost for small-scale machines
Suggestions for addressing the	Establish Cashew innovation platforms
challenges	Acquisition of the machines
	Facilitation to visit demonstration site
	• Build capacity through efficient agricultural production to
	afford the cost
Lessons learned in up scaling if	• Chances of successful scaling are higher when diverse value
any	chain stakeholders collaborate in an innovation platform

	• Partnership is important in technology dissemination and
	adoption and this can be facilitated through innovation
	platforms
	 Mechanization in agriculture increases production
	Mechanization releases labour to alternative requirement areas
	 Provides low-cost farm operations
Social anvironmental policy	• Creation of awaraness on machanization importance in
and market conditions	• Creation of awareness on mechanization importance in agricultural production
necessary for development and	• Include all gender groups in research, and validation
up scaling	 Appropriate policy formulation of agricultural mechanization
D: Economic gondor vulnoral	• Appropriate poincy formulation of agricultural mechanization
D. Economic, genuer, vumerat	KES 290,000
Basic costs	KES 260,000
Estimated returns	KES 180,000/ monthly gross income
Gender issues and concerns in	Gender unfriendly and expensive machines
development, dissemination,	• Cashew machines should be designed for easy start and
adoption and scaling up	operation.
	• Up-scaling should target all the gender
	Affordability to all gender
Gender related opportunities	Creates employment especially for youth and reduces drudgery for
	women farmers as well as men
VMG issues and concerns in	Facilitation to access information
development, dissemination,	• Affordability and easy to maintain machines
adoption and scaling up	
VMG related opportunities	Can create employment for VMG at local level
E: Case studies/profiles of succ	ess stories
Success stories from previous	Mechanization has enabled increased production in other crops
similar projects	such as maize, wheat, finger millet and rice
Application guidelines for	Demonstrations and training
users	User manuals
F: Status of TIMP readiness	1. Ready for up scaling
(1-ready for up scaling; 2-	
requires validation; 3-requires	
further research)	
G: Contacts	
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	Phone: 0711369535; 0710906600
Lead organization and	KALRO: Nasirembe W., Pole F.N
scientists	Egerton University
Partner organizations	Local Fabricators

TIMP Name	4-Wheeled Tractor 50Hp	
Category (i.e. technology, innovation or management practice)	Technology Image: Constraint of the second	
A: Description of the technology	, innovation or management practice	
Problem to be addressed	Slow and tedious processes of land preparation, in a commercialized cashew commodity Delayed operation lead to late planting and high cost of manual Labour	
What is it? (TIMP description)	Its a small sized, 4-wheeled tractor with a low powered agricultural implement of 40-55hp that can be fitted with a rotary tiller, disk harrow, mouldboard plough, trailer, chisel or water pump at alternate times for easing farm operations. It can do 4 hectares per day by one operator but can have two operators to run another 8 hours of 4 hectares coming to 8ha per day. This varies depending on the climatic conditions, soil types, soil moisture content and operator experience. Fuel consumption is about 15 litres per ha. Though these results may vary with the technical ability of the operator.	
Justification	It has multiple uses when coupled with other equipment such as seedbed preparation, sowing seed, spraying fertilizer, herbicide and even irrigation. It can also be used for threshing through a power take off device and transporting produce. Farm sizes less than one hectare may limit maneuverability of conventional tractors yet manual Labour is costly and slow.	
B: Assessment of dissemination and scaling up/out approaches		
Users of TIMP	Cashew farmers, agripreneurs and researchers	
Approaches used in dissemination	 Use of on-farm demos, exhibition during field days, farmer to farmer training and agricultural shows Mass media (TV and radio programs, promotional materials leaflets, posters, brochures, manuals and pamphlets) Use of digital platforms comprising web materials, mobile telephone applications and short message services (SMS) Regular localized meetings Farmer field and business Schools (FFBS) Agricultural Innovation Platforms (AIP) 	

2.11.2 4-Wheeled Tractor 50Hp

Critical/essential factors for	• Applied and adaptive research to evaluate and recommend the
successful promotion	tractor for small scale farmers.
F	• A platform for interaction of cashew value chain stakeholders
	• Multiple usage, timeliness, efficiency and low cost
Partners/stakeholders for scaling	KALRO, Universities (for information)
up and their roles	Machinery dealers
-	NGOs - supporting farmers for dissemination
C: Current situation and future	scaling up
Counties where already	Kwale, Kilifi, Lamu, Tana-River, Baringo, Machakos
promoted if any	
Counties where TIMP will be up scaled	Machakos
Challenges in dissemination	• Lack of cashew innovation platforms to facilitate interaction
	of farmers with relevant stakeholders
	• Lack of tractors
	• Lack of facilitation to demonstration site
	High initial cost for small-scale machines
Suggestions for addressing the	• Establish a 4-wheeled tractor innovation platform
challenges	Acquisition of the machines
	Facilitation to demonstration site
	Build financial capacity through efficient agricultural
	production to afford the cost
Lessons learned in up scaling if	• Chances of successful up-scaling are higher when diverse
any	value chain stakeholders collaborate in an innovation platform
	• Partnership is important in technology dissemination and
	adoption
	Mechanization in agriculture increases production
	• Mechanization releases labour to alternative requirement
	areas
	Provides low-cost farm operations
Social, environmental, policy	• Creation of awareness on mechanization importance in
and market conditions necessary	agricultural production
for development and up scanng	 Appropriate policy formulation of agricultural mechanization
D: Economic, gender, vulnerable	e and marginalized groups (VMGs) considerations
Basic costs	KES 1,780,000,00
Estimated returns	KES 450,000/ monthly gross income
Gender issues and concerns in	• Gender unfriendly and expensive to buy
development, dissemination,	• Cashew machines should be designed for easy start and
adoption and scaling up	operation.
	• Up-scaling should target all the gender
	Affordability to all gender
Gender related opportunities	Creates employment especially for youth and reduces drudgery
	for women farmers as well as men
VMG issues and concerns in	Facilitation to access information
development, dissemination,	• Affordability and easy to maintain machines
adoption and scaling up	

VMG related opportunities	Can create employment for VMG at local level	
E: Case studies/profiles of success stories		
Success stories from previous	Mechanization has enabled increased production in other crops	
similar projects	such as maize, wheat, finger millet and rice	
Application guidelines for users	Demonstrations and training	
	User manuals	
F: Status of TIMP readiness	1. Ready for up scaling	
(1-ready for up scaling; 2-		
requires validation; 3-requires		
further research)		
G: Contacts		
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Lead organization and scientists	KALRO :Nasirembe W., Pole F.N,	
	Egerton University	
Partner organizations	Local Fabricators	

2.11.3 Mouldboard Plough

TIMP Name	Mouldboard Plough
Category (i.e. technology, innovation or management practice)	Technology Technology Mouldboard Plough
A: Description of the technology,	innovation or management practice
Problem to be addressed	 Slow and tedious processes of land preparation, in a commercialized cashew commodity Difficult to prepare a uniform fine tilled seedbed manually Delayed operation leading to late planting High cost of manual Labour
what is it? (Thyp description)	It is an agricultural implement that is generally considered to be an

Instification	important tillage implement. Mouldboard ploughs are available for power tiller and tractor operation. A mouldboard plough can perform various jobs such as cutting the furrow slice, lifting the furrow slice inverting the furrow slice and pulverizing the furrow slice. It is suitable for water conservation. Ploughing accounts for more traction energy than any other field operation.
	seeks the desired depth. It is versatile. The various models have different features that enable high efficiency in preparation of the land, weed control, pest control and Improve soil health.
B: Assessment of dissemination a	nd scaling up/out approaches
Users of TIMP	Cashew farmers, agripreneurs and researchers
Approaches used in dissemination	 Use of on-farm demos, exhibition during field days, farmer to farmer training and agricultural shows Mass media (TV and radio programs, promotional materials leaflets, posters, brochures, manuals and pamphlets) Use of digital platforms comprising web materials, mobile telephone applications and short message services (SMS) Regular localized meetings Farmer field and business Schools (FFBS) Agricultural Innovation Platforms (AIP)
Critical/essential factors for successful promotion	 Applied and adaptive Research to test, validate and promote mouldboard plough. A platform for interaction of cashew value chain stakeholders Multiple usage, timeliness, efficiency and low cost
Partners/stakeholders for scaling up and their roles	 KALRO, Universities (for information) Machinery fabricators NGO supporting farmers for dissemination
C: Current situation and future s	caling up
Counties where already promoted if any	Kwale, Kilifi, Lamu, Tana-River, Baringo, Machakos
Counties where TIMP will be up scaled	Kwale, Kilifi, Lamu, Tana-River
Challenges in dissemination	 Lack of cashew innovation platforms to facilitate interaction of farmers with relevant stakeholders Lack of machines Lack of facilitation to demonstration site High initial cost for small-scale machines
Suggestions for addressing the challenges	 Establish Cashew innovation platforms Acquisition of the machines Facilitation to demonstration site Build capacity through efficient agricultural production to afford the cost
Lessons learned in up scaling if any	 Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms

	Mechanization in agriculture increases production
	• Mechanization releases labour to alternative requirement
	areas
	• Provides low-cost farm operations
Social environmental policy and	Creation of awareness on mechanization importance in
market conditions necessary for	agricultural production
development and up scaling	 Include all gender groups in research and validation
development and up seaming	 Appropriate policy formulation of agricultural mechanization
D. Economic gender vulnerable	and marginalized groups (VMGs) considerations
Basic costs	KES 550 000
Estimated natures	KES 180,000/monthly gross in some
Estimated returns	KES 180,000/ monthly gross income
Gender issues and concerns in	Gender unfriendly and expensive machines
development, dissemination,	• Cashew machines should be designed for easy start and
adoption and scaling up	operation.
	• Up-scaling should target all the gender
	Affordability to all gender
Gender related opportunities	Creates employment especially for youth
	Reduces drudgery for women farmers as well as men
VMG issues and concerns in	Facilitation to access information
development, dissemination,	Affordability and easy to maintain machines
adoption and scaling up	
VMG related opportunities	Can create employment for VMG at local level
E: Case studies/profiles of success	s stories
Success stories from previous	Mechanization has enabled increased production in other crops
similar projects	such as maize, wheat, finger millet and rice
Application guidelines for users	Demonstrations and training
	User manuals
F: Status of TIMP readiness (1.	1. Ready for up scaling
Ready for up scaling; 2. Requires	
validation; 3. Requires further	
research)	
G: Contacts	<u>.</u>
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Lead organization and scientists	KALRO, Egerton University
	Nasirembe W., Pole F.N.
Partner organizations	Local Fabricators

2.11.4 Disk Harrow

TIMP Name	Disk Harrow
Category (i.e. technology, innovation	Technology
or management practice)	
	<u> </u>
	E and the set
	Filer Reary Inc.
	Disk Harrow
A: Description of the technology, inn	lovation or management practice
Problem to be addressed	• Slow and tedious processes of seedbed preparation, in a
	commercialized cashew farm and difficult in breaking
	clods manually
	Delayed operation leading to late planting
	• Low acreage because of using manual labour
What is it? (TIMD description)	High cost of manual labour It is an implement consisting of a beauty frame set with disks
what is it? (Thirp description)	on a gang which is dragged over ploughed land to break up
	clods, remove or burry weeds, cover weed seed and is a
	cultivating tool set used primarily for breaking up and
	smoothening the soil in preparation of a seedbed for auguring.
Justification	• Creating of a crumbly layer for planting is tedious. It is
	not possible to manually protect the soil surface from
	rapid drying. Improving both the air and water
	 Manual operation will reduce microbiological processes
	in the soil Manual land harrowing Improves nutrient
	availability to plants.
B: Assessment of dissemination and	scaling up/out approaches
Users of TIMP	Cashew farmers, agripreneurs and researchers
Approaches used in dissemination	• Use of on-farm demos, exhibition during field days,
	farmer to farmer training and agricultural shows
	• Mass media (1 v and radio programs, promotional materials leaflets posters brochures manuals and
	pamphlets)
	• Use of digital platforms comprising web materials,
	mobile telephone applications and short message services
	(SMS)
	 Regular localized meetings Farmer field and business Schools (FFBS)

	Agricultural Innovation Platforms (AIP)
	•
Critical/essential factors for	• Applied and adaptive research to test, validate and release
successful promotion	improved cashew varieties
	• A platform for interaction of cashew value chain
	stakeholders
	Multiple usage, timeliness, efficiency and low cost
Partners/stakeholders for scaling up	• KALRO, Universities (for information)
and their roles	Machinery fabricators
	NGO - supporting farmers for dissemination
C: Current situation and future scal	ing up
Counties where already promoted if	Kwale, Kilifi, Lamu, Tana-River, Makueni, Kitui, Baringo
any	
Counties where TIMP will be up	Machakos
scaled	
Challenges in dissemination	• Lack of cashew innovation platforms to facilitate
	interaction of farmers with relevant stakeholders
	 Lack of facilitation for a demonstration site
	 Lack of facilitation for a demonstration site High initial cost for small-scale machines
Suggestions for addressing the	Fstablish Cashew innovation platforms
challenges	Acquisition of the machines
chancinges	 Build capacity through efficient agricultural production to
	afford the cost
Lessons learned in up scaling if any	• Chances of successful scaling are higher when diverse
	value chain stakeholders collaborate in an innovation
	platform
	• Partnership is important in technology dissemination and
	adoption, and this can be facilitated through innovation
	platforms
	Mechanization in agriculture increases production
	• Mechanization releases labour to alternative requirement
	areas
	Provides low-cost farm operations
Social, environmental, policy and	• Creation of awareness on mechanization importance in
development and up scaling	• Include all gender groups in research and validation
development and up scaling	 Include all gender groups in research and validation. Appropriate policy formulation of agricultural
	• Appropriate poncy formulation of agricultural
D: Economic, gender, vulnerable and	d marginalized groups (VMGs) considerations
Basic costs	KES 280 000
Estimated returns	KES 180 000/ monthly gross income
Gender issues and concerns in	Gender unfriendly and expansive machines
development, dissemination	Cashew machines should be designed for easy start and
adoption and scaling up	• Cashew machines should be designed for easy start and
accention and beaming up	• Up cooling should target all the coorder
	• Op-scaling should larget all the gender
	• The machines should be affordable to both genders
Gender related opportunities	Creates employment especially for youth

	Reduces drudgery for women farmers as well as men
VMG issues and concerns in	Facilitation to access information
development, dissemination,	• Affordability and easy to maintain machines
adoption and scaling up	
VMG related opportunities	Can create employment for VMG at local level
E: Case studies/profiles of success st	ories
Success stories from previous similar	Mechanization has enabled increased production in other
projects	crops such as maize, wheat, finger millet and rice
Application guidelines for users	Demonstrations and training
	• User manuals
F: Status of TIMP readiness (1-	Ready for up scaling
ready for up scaling; 2-requires	
validation; 3-requires further	
research)	
G: Contacts	
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	Egerton University
	,
Partner organizations	Local Fabricators

2.11.4 Hole Drill

TIMP Name	Hole drill
Category (technology, innovation or	Technology
management practice)	Hole drill
A: Description of the technology, innovation or	management practice

Problem to be addressed	Manual diaging increases the cost of making
r lobielli to be addressed	planting holes. It is a slow and tadious processes. It
	plaining noies. It is slow and tedious processes. It
	as also difficult to prepare uniformity spaced
	contour noies. Derayed operation leading to rate
What is it? (TDAD lasering is a)	planting.
what is it? (Thyp description)	Hole digger is a Power Take Off (PTO) driven
	machine that augers noies in rows at equal
	distances as desired mechanically and
	economically. It can also be used for note making
	in electric poles and farm hedges. It is best suited
	for the plantations. It can auger down to about
	90cm deep and have a consistent diameter in just
Instification	The output makes a definite and uniform hale
Justification	diameters and deaths as desired selected from the
	auger specifications. Users spend 50 times shorter
	a time and as little as 90ml of fuel to auger a hole
	It august as it removes detached soil forming a
	much neater hole with a well-defined
	circumference Holes can be made at pre-defined
	point by driving the compact tractor. It is easy to
	use
B: Assessment of dissemination and scaling un/	out approaches
Users of TIMP	Cashew farmers and researchers
Approaches used in dissemination	• Use of on-farm demos exhibition during field
	days, farmer to farmer training and
	agricultural shows
	• Mass media (TV and radio programs,
	promotional materials leaflets, posters,
	brochures, manuals and pamphlets)
	• Use of digital platforms comprising web
	materials, mobile telephone applications and
	short message services (SMS)
	Regular localized meetings
	• Farmer field and business Schools (FFBS)
	Agricultural Innovation Platforms (AIP)
Critical/essential factors for successful	• Applied and adaptive research to evaluate and
promotion	recommend the machine usage.
	• A platform for interaction of cashew value
	chain stakeholders
	• Multiple usage, timeliness, efficiency and low
	cost
Partners/stakeholders for scaling up and their	• KALRO, Universities (for information)
roles	Machinery fabricators
	NGOs - for supporting farmers for
	dissemination
C: Current situation and future scaling up	1
Counties where already promoted if any	Kilifi, Kwale, Lamu
	All counties where cashew farming is an important

	activity
Challenges in dissemination	• Lack of cashew innovation platforms to
	facilitate interaction of farmers with relevant
	stakeholders
	Lack of machines
	• Lack of facilitation to demonstration sites
	High initial cost for small-scale machines
Suggestions for addressing the challenges	 Establish Cashew innovation platforms
	 Acquisition of the machines
	Facilitation to demonstration site
	• Build capacity through efficient agricultural
	production to make the machines affordable
Lessons learned in up scaling if any	• Chances of successful scaling are higher when
	diverse value chain stakeholders collaborate in
	an innovation platform
	• Partnership is important in technology
	dissemination and adoption and this can be
	facilitated through innovation platforms
	Mechanization in agriculture increases
	production
	• Mechanization releases labour to alternative
	requirement areas
	Provides low-cost farm operations
Social, environmental, policy and market	• Creation of awareness on mechanization
conditions necessary for development and up	importance in agricultural production
scanng	• Include all gender groups in research, and
	validation.
	• Appropriate poincy formulation of agricultural
D: Economic, gender, vulnerable and marginal	ized groups (VMGs) considerations
Basic costs	KES 40.000 (power auger digger). KES 80.000
	(Tractor mounted hole digger)
Estimated returns	KES 20,000/ monthly gross income
Gender issues and concerns in development,	• Gender unfriendly and expensive machines
dissemination, adoption and scaling up	• The machines should be designed for easy
	start and operation.
	• Up-scaling should target all the genders
	Affordable to all genders
Gender related opportunities	• Creates employment especially for youth
	• Reduces drudgery for women farmers as well
	as men
VMG issues and concerns in development,	Facilitation to access information
dissemination, adoption and scaling up	• Affordability and easy to maintain machines
VMG related opportunities	Can create employment for VMG at local level
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mechanization has enabled increased production
	in other crops such as maize, wheat, finger millet
	and rice
Application guidelines for users	User manuals and leaflets

F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
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Partner organizations and contacts	Local Fabricators

2.11.5 Backpack weeder

TIMP Name	Backpack weeder
Category (technology, innovation or management practice)	Technology
A: Description of the technology	, innovation or management practice
Problem to be addressed	 Manual weeding is slower and untimely Manual labour is diminishing escalating its cost Inconsistence in basin digging when manually done Manual labour is costly
What is it? (TIMP description)	Backpack weeder is a machine that weighs about 6kgs. It is carried on your back like a backpack and its blades are directed to the weeding area. It has capability of weeding about 1 ha of land in a day which is equivalent to the amount of work done by 10 people on the same farm in a day. Apart from the issue of easy transportation, it keeps operator's balance and while working, the operator focuses more on eliminating weeds than stability.
Justification	 It's cost effective compared to Manpower Weeding season is the most tedious in farming and employing 10 farm workers will definitely cost more. Easy to work with

	Tremendously increases agricultural and horticultural
	working area
B: Assessment of dissemination	and scaling up/out approaches
Users of TIMP	Cashew Farmers and agripreneurs
Approaches used in	• Use of on-farm demos, exhibition during field days, farmer to
dissemination	farmer training and agricultural shows
	• Mass media (TV and radio programs, promotional materials
	leaflets, posters, brochures, manuals and pamphlets)
	• Use of digital platforms comprising web materials, mobile
	telephone applications and short message services (SMS)
	• Regular localized meetings
	• Farmer field and business Schools (FFBS)
Critical/accortial factors for	• Agricultural innovation Platforms (AIP)
critical/essential factors for	• Applied and adaptive research to test, validate and promote healthealth wooder machine
successful promotion	• A platform for interaction of cachew value chain stakeholders
Partners/stakeholders for scaling	 A platform for interaction of cashew value chain stakeholders Machinery fabricators
up and their roles	 NGO supporting farmers(AGGRA)
C: Current situation and future	scaling un
Counties where already	Not vet promoted
promoted if any	Not yet promoted
Counties where TIMP will be up	Kilifi, Kwale, Taita Tayeta, Lamu and Tana River
scaled	,,,,,
Challenges in dissemination	• Lack of cashew innovation platforms to facilitate interaction
_	of farmers with relevant stakeholders
	• Relatively high cost for individual small-scale farmer.
	• Limited awareness of the existence of machine by the
	farming community.
Suggestions for addressing the	Establish Cashew innovation platforms
challenges	• Encourage group/co-operative ownership
	• Launch and awareness campaign through demonstrations and
T 1 1 1 1 1 1 1 1 1 1	trainings
Lessons learned in up scaling if	• Chances of successful scaling are higher when diverse value
any	Destroyshin is important in tash alogy discomination and
	• Partnership is important in technology dissemination and adoption and this can be facilitated through innovation
	nlatforms
	 Products from local/indigenous crops attract huge market vet
	very little is being done to promote growth
Social, environmental, policy	• Creation of awareness on mechanization importance in the
and market conditions necessary	community. Include all gender groups in research, and
for development and up scaling	validation.
	Good Policy on cost of agricultural mechanization
D: Economic, gender, vulnerable	e and marginalized groups (VMGs) considerations
Basic costs	Not yet determined
Estimated returns	Not yet determined
Gender issues and concerns in	• Gender unfriendly and expensive machines
development, dissemination,	

adoption and scaling up Gender related opportunities VMG issues and concerns in deve	 Cashew machines should be designed for easy start and operation. Up-scaling should target all the gender Affordability to all gender Creates employment especially for youth Reduces drudgery for women farmers as well as men lopment, dissemination, adoption and scaling up
F : Case studios/profiles of succe	se storios
E: Case studies/promes of succe	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat and rice
Application guidelines for users	1. User manuals 2. Leaflets
F: Status of TIMP readiness (1- ready for up scaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
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Lead organization and scientists	KALRO, Nasirembe W., Pole F.N. Egerton University.
Partner organizations and contacts	Local Fabricators

2.11.6 Motorized Sprayer

TIMP Name	Motorized Sprayer
Category (technology,	Technology
innovation or management	Nozzle Guide for Band and Directed Spraying
practice)	See Fair fair See
	Herbicides Pre-image Pre-image Systemic Post-image Systemic Very Sood Very Sood Very Sood Very Sood Very Sood Very Sood
	Fungicides Contact Good Systemic Very Good Good Very Good
	Insecticides Contact Systemic Very Good Very Good Very Good Very Good Good
	Growth Regulators Good Very Good
	Motorized Sprayer
A: Description of the technology, innovation or management practice	

Problem to be addressed	Slow and tedious processes of manual spraying of cashew; The	
	height of the tree requires a long projectile spray which cannot be	
	attained by a manual knapsack; Cashew has a high number of pests	
	that invade leaf, flowers and nut.	
What is it? (TIMP description)	A motorized sprayer is a device used to spray a liquid, where	
	sprayers are commonly used for projection of the chemicals	
	In agriculture, a sprayer is a piece of equipment that is used to	
	apply herbicides, pesticides, and fertilizers on agricultural crops.	
	Sprayers are man-portable units typically backpacks with spray	
	guns. They are used to control; weeds that can harbour insects by	
	use of herbicides, insect pests that can cause diseases by the use of	
	insecticides as well as pesticides. Control of fungal diseases by the	
	use of fungicides. Application of micronutrients on the plants.	
Justification	Pests reduce yields by up to 98% and are a major menace in	
	agricultural production. Before cashew forms a canopy, broad	
	leafed weeds compete with cashew seeding for nutrients and light,	
	greatly reducing their yield. Manual sprayers are labour intensive,	
	while spraying labour is too expensive. It has lower pressure	
	reducing its efficiency hence a motorized knapsack comes in	
	nandy.	
B: Assessment of dissemination	and scaling up/out approaches	
A mensach as used in	• Casnew Farmers and agripreneurs	
Approaches used in	• Use of on-farm demos, exhibition during field days, farmer to	
dissemination	• Mass modia (TV and radio programs, promotional materials	
	• Mass media (1 v and radio programs, promotional materials	
	• Use of digital platforms comprising web materials mobile	
	• Use of digital platforms comprising web materials, mobile telephone applications and short message services (SMS)	
	Regular localized meetings	
	 Farmer field and husiness Schools (FERS) 	
	 Agricultural Innovation Platforms (AIP) 	
Critical/essential factors for	Applied and adaptive research to test validate and promote	
successful promotion	the motorized spraver	
successial promotion	• A platform for interaction of cashew value chain stakeholders	
	• Use by Farmers	
Partners/stakeholders for scaling	Machinery fabricators	
up and their roles	• NGO supporting farmers(AGGRA)	
C: Current situation and future scaling up		
Counties where already	Kilifi, Kwale, Taita Taveta, Lamu	
promoted if any		
Counties where TIMP will be up	counties where cashew farming is an important activity	
scaled		
Challenges in dissemination	• Lack of cashew innovation platforms to facilitate interaction	
	of farmers with relevant stakeholders	
	• Relatively high cost for individual small-scale farmer.	
	• Limited awareness of the existence of machine among some	
	farmers.	
Suggestions for addressing the	Establish Cashew innovation platforms	
challenges	• Encourage group/co-operative ownership	

	• Launch and awareness campaign through demonstrations and
	trainings
Lessons learned in up scaling if	• Chances of successful scaling are higher when diverse value
any	chain stakeholders collaborate in an innovation platform
	 Partnership is important in technology dissemination and
	adoption and this can be facilitated through innovation
	platforms
	• Products from local/indigenous crops attract huge market, yet
	very little is being done to promote growth
Social, environmental, policy	• Creation of awareness on mechanization importance in the
and market conditions necessary	community. Include all gender groups in research, and
for development and up scaling	validation.
	Good Policy on cost of agricultural mechanization
D: Economic, gender, vulnerabl	e and marginalized groups (VMGs) considerations
Basic costs	Motorized sprayer 55,000 KES per unit
Estimated returns	KES 180,000.00/year
Gender issues and concerns in	Motorized sprayer designed for easy start and operation. Men
development, dissemination,	have been drawn to spraying by the machine. This task was
adoption and scaling up	predominantly for women before the introduction of the machine.
dissemination	
Gender related opportunities	Creates employment at production, transportation, processing
Conden mileted encontruction	and distribution
Gender related opportunities	• Creates employment especially for the youth
	Reduces drudgery for women farmers as well as men
VMG issues and concerns in	• Facilitation to access information
development, dissemination,	• Affordability and easy to maintain machines
E: Case studies/profiles of	
E: Case studies/promes of success stories	
Success stories from previous	Mechanization has enabled increased production in other crops
similar projects	such as maize, wheat, finger millet and rice
Application guidelines for users	User manuals and leaflets
F: Status of TIMP readiness	2 Requires validation
(1-ready for upscaling; 2-	
requires validation; 3-requires	
further research)	
G: Contacts	
Contacts	The Institute Director
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	Email: director.amri@kalro.org
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Lead organization and scientists	KALRO Nasirembe W
	Egerton University
Partner organizations and	Local Fabricators
contacts	

TIMP Name **Power tree pruner** Category (technology, Technology innovation or management practice) Power tree pruner A: Description of the technology, innovation or management practice Problem to be addressed Manual pruning is slower and untimely. Manual pruning requires a ladder that increases cost of pruning and also subjecting the pruner to danger of falling. Manual labour is diminishing escalating its cost. What is it? (TIMP description) A powered pole tree pruner consists of a small chainsaw mounted on a long shaft, enabling the operator to cut through high tree branches while standing at ground level. Power pruners are used to make smaller cuts on branches or shrubs. As the name suggests, pruners are used to prune trees. Less powerful than chainsaws, the cutting diameter of power pruners will be smaller as the chain guide is shorter. A power pruner is basically a motorized version of a manual pole pruner or branch cutter. Justification The machine works faster, has a low engine capacity of < 30cc. The machine is telescopic and can reach far end branches at will. Uses gasoline available in remote sites and discourages child labour B: Assessment of dissemination and scaling up/out approaches Users of TIMP Cashew Farmers and agripreneurs Approaches used in Use of on-farm demos, exhibition during field days, farmer to dissemination farmer training and agricultural shows Mass media (TV and radio programs, promotional materials • leaflets, posters, brochures, manuals and pamphlets) Use of digital platforms comprising web materials, mobile telephone applications and short message services (SMS) Regular localized meetings Farmer field and business Schools (FFBS) Agricultural Innovation Platforms (AIP) Public and private agricultural extension services. Critical/essential factors for Applied and adaptive Research to test, validate and promote power successful promotion tree pruner

2.11.7 Power tree pruner

	A platform for interaction of cashew value chain stakeholders
Partners/stakeholders for	Machinery fabricators
scaling up and their roles	NGO supporting farmers(AGGRA)
C: Current situation and futur	e scaling up
Counties where already promoted if any	Not yet promoted
Counties where TIMP will be up scaled	Kilifi, Kwale, Taita Taveta and Lamu
Challenges in dissemination Suggestions for addressing the challenges	 Lack of cashew innovation platforms to facilitate interaction of farmers with relevant stakeholders Relatively High cost for individual small-scale farmer. Limited awareness of the existence of machine by the farming community. Establish Cashew innovation platforms Encourage group/cooperative ownership Launch and awareness campaign through demonstrations and trainings
Lessons learned in up scaling if any	 Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms Products from local/indigenous crops attract huge market, yet very little is being done to promote growth
Social, environmental, policy and market conditions necessary for development and up scaling D: Economic, gender, vulnerable and marginalized	 Creation of awareness on mechanization importance in the community. Include all gender groups in research, and validation. Good policy on cost of agricultural mechanization
groups (VMGs)	
considerations	Not not determined
Basic costs	Not yet determined
Esumated returns	Not yet determined
development ,dissemination, adoption and scaling up	Cashew machines should be designed for easy start and operation. Up-scaling should target all the gender Affordability to all gender
Gender related opportunities	Training on local use and transportation will make it more utilized. Power tree pruner is affordable and could help VMGs exploit
VMG issues and concerns in dev	elopment, dissemination, adoption and scaling up
VMG related opportunities	Can create employment for VMG at local level
E: Case studies/profiles of	
success stories	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat and rice
Application guidelines for	1. User manuals
users	2. Leaflets

F: Status of TIMP readiness	
(1-ready for up scaling; 2-	3. Requires further research
requires validation; 3-requires	
further research)	
G: Contacts	
Contacts	The Institute Director, KALRO AMRI -Katumani;
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	Phone: 0711369535; 0710906600
Lead organization and	KALRO, Egerton University,
scientists	Nasirembe W, Pole F.N.
Partner organizations and	Local Fabricators
contacts	

2.11.8 Grafting robot

TIMP Name	Grafting robot
Category (technology, innovation or	Grafting robot Technology
management practice)	
	C. STREAM
	A RANGE AND A
	•
A: Description of the technology, in	novation or management practice
Problem to be addressed	Lack of cashew grafted planting material
	High cost of labour
	Manual labour is diminishing
	Grafting success rate is low
What is it? (TIMP description)	An automated grafting robot is a machine which can
	implement clipping, moving, positioning, cutting, binding,
	results indicate that the grafting success rate of most robot is
	87.3% and the binding success rate is 68.9%.
Justification	Robot automatically grafts species that guarantee rich and
	high-quality harvesting and are strong against diseases. By
	using robot technology, hand labour can be eliminated. The
	whole idea of grafting is to combat soil-borne diseases by
	using two types of rootstocks.

B: Assessment of dissemination and	scaling up/out approaches
Users of TIMP	Cashew Farmers and agribusiness entrepreneurs
Approaches used in dissemination	 Use of on-farm demos, exhibition during field days, farmer to farmer training and agricultural shows Mass media (TV and radio programs, promotional materials leaflets, posters, brochures, manuals and pamphlets) Use of digital platforms comprising web materials, mobile telephone applications and short message services (SMS) Regular localized meetings Farmer field and business Schools (FFBS) Agricultural Innovation Platforms (AIP)
Critical/essential factors for successful promotion	 Applied and adaptive research to test, validate and promote grafting robot. A platform for interaction of cashew value chain stakeholders Use by Farmers
Partners/stakeholders for scaling up	Machinery fabricators
and their roles	NGO supporting farmers (AGGRA)
C: Current situation and future scal	ing up
any	Not yet promoted
Counties where TIMP will be up scaled	Lamu, Kilifi, Kwale
Challenges in dissemination	• Lack of cashew innovation platforms to facilitate interaction of farmers with relevant stakeholders
Suggestions for addressing the challenges	 Establish Cashew innovation platforms Encourage group/cooperative ownership Launch and awareness campaign through demonstrations and trainings
Lessons learned in up scaling if any	 Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms Products from local/indigenous crops attract huge market, yet very little is being done to promote growth
Social, environmental, policy and	• Creation of awareness on mechanization importance in
development and up scaling	 the community. Include all gender groups in research, and validation. Good Policy on cost of agricultural machanization
D. Economic gender vulnerable an	d marginalized groups (VMCs) considerations
Basic costs	To be determined
Estimated returns	To be determined

Gender issues and concerns in	Cashew grafting robot designed for easy start and operation.
development, dissemination,	
adoption and scaling up	
dissemination	
Gender related opportunities	Creates employment at production, transportation,
	processing and distribution
VMG issues and concerns in	Training on local use and transportation will make it more
development, dissemination,	usable.
adoption and scaling up	Grafting tool is affordable and could help VMGs exploit
VMG related opportunities	Can create employment for VMG at local level
E: Case studies/profiles of success stories	
Success stories from previous	Mechanization has enabled increased production in other
similar projects	crops such as maize, wheat and rice
Application guidelines for users	User manuals and leaflets
F: Status of TIMP readiness (1-	2 Requires validation
ready for upscaling; 2-requires	
validation; 3-requires further	
research)	
G: Contacts	
Lead organization and scientists	The Institute Director, KALRO AMRI -Katumani;
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Partner organizations and contacts	Local Fabricators

2.11.9 Grafting Tool

TIMP Name	Grafting Tool
Category (technology, innovation management practice)	Technology Grafting tool
A: Description of the technology	y, innovation or management practice
Problem to be addressed	Lack of cashew grafted planting material
	High cost of labour
	Normal knife is not as convenient
What is it? (TIMP description)	A grafting tool works perfect on hardy plants, especially on fruit
	trees. It has replaceable grafting cutting blades: cut, U cut and V
	cut, each blade with two cutter points. This tool is designed with
	cutting groove on cutting board. It is easy for you to prune branch
	into U shape, V shape. Its handles are made from ABS plastic, the

	rest part and blades are made from high carbon steel, chrome
	treated for durable sharpness.
Justification	Grafting allows the gardener to provide a longer growing season
	and a greater diversity of plant varieties. Despite being Labour
	intensive, grafting is commonly undertaken as a means of
	vegetative propagation of woody plants for any or all of the
	following reasons for example imparting disease resistance or
	hardiness contributed by the rootstock, Seedlings grown trees will
	live longer than grafted trees or cutting grown trees, they are more
	vigorous and grow slightly larger. If a grafted tree is hit hard by
	frost, the graft will usually die off, but the rootstock will survive.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Cashew Farmers and agribusiness entrepreneurs
Approaches used in	• Use of on-farm demos, exhibition during field days, farmer
dissemination	to farmer training and agricultural shows
	• Mass media (IV and radio programs, promotional materials
	leaflets, posters, brochures, manuals and pamphlets)
	• Use of digital platforms comprising web materials, mobile
	• Degular localized mactings
	 Regular focalized meetings Former field and husiness Schools (FEDS)
	• Failure Internation Distress Schools (FFDS)
Critical/assential factors for	 Applied and adaptive Desearch to test validate and promote.
successful promotion	• Applied and adaptive Research to test, validate and promote grafting tool
successful promotion	• A platform for interaction of cashew value chain stakeholders
Partners/stakeholders for scaling	Machinery fabricators
up and their roles	NGO supporting farmers(AGGRA)
C: Current situation and future	scaling up
Counties where already	Not vet promoted
promoted if any	
Counties where TIMP will be up	Lamu, Kilifi, Kwale and Tana River
scaled	
Challenges in dissemination	• Lack of cashew innovation platforms to facilitate interaction
	of farmers with relevant stakeholders
	• Relatively High cost for individual small-scale farmer.
	• Limited awareness of the existence of machine by the
	farming community.
Suggestions for addressing the	 Establish Cashew innovation platforms
challenges	
Lessons learned in up scaling if	• Chances of successful scaling are higher when diverse value
any	chain stakeholders collaborate in an innovation platform
	• Partnership is important in technology dissemination and
	adoption and this can be facilitated through innovation
	platforms
	• Products from local/indigenous crops attract huge market,
Cocicl environmental 1	yet very little is being done to promote growth
social, environmental, policy	• Creation of awareness on mechanization importance in the
for development and up applies	community. Include all gender groups in research, and
for development and up scamp	vanuauon.

	Good policy on cost of agricultural mechanization		
D: Economic, gender, vulnerable	e and marginalized groups (VMGs) considerations		
Basic costs	To be determined		
Estimated returns	To be determined		
Gender issues and concerns in	Cashew grafting tool is designed for easy start and operation.		
development, dissemination,			
adoption and scaling up			
dissemination			
Gender related opportunities	Creates employment at production, transportation, processing and		
	distribution		
VMG issues and concerns in	Facilitation to access information		
development, dissemination,	Affordability and easy to maintain machines		
adoption and scaling up			
VMG related opportunities	Can create employment for VMG at local level		
E: Case studies/profiles of			
success stories			
Success stories from previous	Mechanization has enabled increased production in other crops		
similar projects	such as maize, wheat and rice		
Application guidelines for users	User manuals and leaflets		
F: Status of TIMP readiness	Requires validation		
(1-ready for upscaling; 2-			
requires validation; 3-requires			
further research)			
G: Contacts			
Contacts	The Institute Director, KALRO AMRI -Katumani;		
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	Phone: 0711369535; 0710906600		
Lead organization and scientists	KALRO, Egerton University,		
	Nasirembe W., Pole F.N.		
Partner organizations and	Local Fabricators		
contacts			
2.10.11 TIMP Name	Harvesting machine		
--	--	--	--
Category: (technology,	Technology		
innovation or management			
practice)			
	antimumula and a second s		
	Harvestina machine		
A: Description of the technology	gy, innovation or management practice		
Problem to be addressed	Manual harvesting is slower and untimely		
	High cost of labour		
	Manual labour is diminishing		
What is it? (TIMP description)	It is a machine used in tree topping, overhead fruit harvesting and		
	general overhead work. This towable boom lift offers ease of		
	operation and transportation to your work site. Some models are		
	fitted with a jib boom which gives the ability of up and over		
	positioning capabilities allowing access to the most difficult work		
	sites		
Justification	The machine works faster, it is telescopic and can reach far end		
	branches. It Uses gasoline as fuel. The machine is cost effective		
	and it discourages child labour		
B: Assessment of dissemination and scaling up/out approaches			
Users of TIMP	Cashew Farmers and agripreneurs		
Approaches used in	• Use of on-farm demos, exhibition during field days, farmer to		
dissemination	farmer training and agricultural shows		
	• Mass media (IV and radio programs, promotional materials		
	leaflets, posters, brochures, manuals and pamphlets)		
	• Use of digital platforms comprising web materials, mobile		
	Demote applications and short message services (SMS)		
	• Regular localized meetings		
	• Farmer field and business Schools (FFDS) • A grigultural Innovation Distforms (AID)		
Critical/assential factors for	Applied and adaptive Passarch to test, validate and promote		
successful promotion	• Applied and adaptive Research to test, variate and promote the harvesting machine		
succession promotion	• A platform for interaction of cashew value chain stakeholders		
	Use by Farmers		
Partners/stakeholders for scaling	Machinery fabricators		
up and their roles	NGO supporting farmers (ACCPA)		
C: Current situation and future	scaling un		
Counties where already	Scanng up Kilifi		
Countres where aready	IXIIIII		

2.11.10 Harvesting machine

promoted if any		
Counties where TIMP will be up	Lamu, Tana River, Kilifi and Kwale.	
scaled		
Challenges in dissemination	• Lack of cashew innovation platforms to facilitate interaction	
	of farmers with relevant stakeholders	
	• Relatively High cost for individual small-scale farmer.	
	• Limited awareness of the existence of machine by the	
	farming community.	
Suggestions for addressing the	Establish Cashew innovation platforms	
challenges	• Encourage group/cooperative ownership	
	• Launch and awareness campaign through demonstrations and	
	trainings	
Lessons learned in up scaling if	• Chances of successful scaling are higher when diverse value	
any	chain stakeholders collaborate in an innovation platform	
	Partnership is important in technology dissemination and	
	adoption and this can be facilitated through innovation	
	nlatforms	
	Products from local/indigenous arons attract huge market yet	
	• Floducts from local/indigenous crops attract huge market, yet	
Secial environmental reliev	Creation of autoremean on machanization importance in the	
Social, environmental, policy	• Creation of awareness on mechanization importance in the	
for development and up seeling	validation	
for development and up scamig	• Good Policy on cost of agricultural mechanization	
D: Economic gondor vulnorabl	• Good Folicy on cost of agricultural mechanization	
D: Economic, genuer, vumerable and marginalized groups (VIVIGS) considerations		
Estimated returns	• Capacity 500 Kg/ hour Fuel 1 litre /hr (4-5 hags)	
	 Needs 3 operators per time 	
	• Weeding charges: KES 300 per hag	
	Requires 1 season to return the KES 125 000 purchase price	
Gender issues and concerns in	Harvesting machine designed for easy start and operation	
development dissemination.	Men have been drawn to Cashew harvesting by the machine	
adoption and scaling up	This task was predominantly for women before the	
dissemination	introduction of the machine.	
Gender related opportunities	Creates employment at production, transportation, processing	
······································	and distribution	
E: Case studies/profiles of success stories		
Success stories from previous	Mechanization has enabled increased production in other crops	
similar projects	such as maize, wheat and rice	
Application guidelines for users	1. Demonstrations and training	
	2. User manuals	
F: Status of TIMP readiness	3. Requires further research	
(1 mandry for unscaling)	-	
(1-ready for upscanng; 2-		
requires validation; 3-requires		
requires validation; 3-requires further research)		
requires validation; 3-requires further research) G: Contacts		
(1-ready for upscaling, 2- requires validation; 3-requires further research) G: Contacts Contacts	The Institute Director, KALRO AMRI -Katumani;	
requires validation; 3-requires further research) G: Contacts Contacts	The Institute Director, KALRO AMRI -Katumani; P.O. Box 340. Machakos	

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Lead organization and scientists	KALRO, Egerton University,
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Partner organizations	Local Fabricators

2.12 Cashew Farming Business and Marketing

2.12.1 Building a business plan

TIMP Name	Building a business plan	
Category (technology, innovation or management practice)	Management practice	
A: Description of the technology, innovation or management practice		
Problem addressed	Farmers lack business plans in Cashew farming opting instead to conduct the business traditionally. This leads to low management and lack of sustainability.	
What is it? (TIMP description)	A cashew farming business plan is as an internal management and organizing tool, used to communicate outside ones business, or both. As a farm plan, it quantifies inputs, costs and returns.	
Justification	A business plan in hand would enable cashew farmers and rural entrepreneurs to create successful and sustainable business. Engagement of farmers in business planning provides market, production and financial information	
B: Assessment of dissemination and scaling up/out approaches		
Users of TIMP	Farmers, agripreneurs, traders, processing industries, extension service, NGOs, research institutions	
Approaches to be used in dissemination	 Use of on-farm demos, exhibition during field days, farmer to farmer training and agricultural shows Mass media (TV and radio programs, promotional materials leaflets, posters, brochures, manuals and pamphlets) Use of digital platforms comprising web materials, mobile telephone applications and short message services (SMS) Regular localized meetings Farmer field and business Schools (FFBS) Agricultural Innovation Platforms (AIP) Public and private agricultural extension services. 	
Critical/essential factors for successful promotion	 Willingness to learn from the trainers of the key concept of good business planning Good trainers with ability to follow through the season Basic education to be able to keep quality records In depth understanding of the Cashew farming as a business Availability of current information of inputs, costs and returns. Investments in the business must yield production of quality tradable volumes 	

	Availability of dependable information storage
	infrastructure and retrieval
Partners/stakeholders for scaling up and their roles	 Farmers - Adoption of' growth strategies (including formation of producer groups, marketing associations and investments in cashew climate smart production strategies County extension staff - Organization of farmers and technical service delivery teams NGOs - Lobbying for organization of farmers into economic-operation entities for ease of service delivery Strengthening of the public-public partnership towards an inputs' subsidy package to stimulate quality production and cost-effective marketing Research institutions –Providing improved seeds and technical backstopping
C: Current situation and future scal	ing up
Counties where already promoted if any	Kilifi, Kwale, Tana River, Lamu, Mombasa, Taita Taveta and Tharaka Nithi
Counties where TIMPs will be up scaled	Lamu
Challenges in development and dissemination - Suggestions for addressing the challenges	 Lack of basic education that constrains good record keeping Lack of Cashew farming knowledge Unwillingness to learn the art of making good business plans Lack of a culture of asking for receipts from sellers of products and services Selection of suitable trainees with basic education Train the farming community on Cashew faming using learning aids that the farmer retains as references Explain important of business plans in decision making Encourage farmers to keep receipts as proof of purchase of goods, services and own sales
Lessons learned in up scaling if any	• There are limited success stories in cashew business planning.
Social, environmental, policy and market conditions necessary for development and up-scaling	 Social conditions – acceptability by the farmers, group dynamics issues including leadership and information sharing under cultural networks Environmental conditions and enhancing natural resource management Observing the health safety and environmental guidelines policy Willingness of all stakeholders to keep and maintain good quality records
D: Economic, gender, vulnerable and	a marginalized groups (VMGs) considerations
Basic costs	To be determined
Estimated returns	No done

Gender issues and concerns in development and dissemination, adoption and scaling Gender related opportunities	 Development and dissemination – Differences in acceptance and practising of the business exist among youth, females and males based on the labour intensity of the tasks. Men and youth take lead in accessing, adopting and scaling/sharing of market related management practices Production opportunities by youth, females and males in
	 the production of cashew especially in nursery establishments and seedling production for cashew Pests' and diseases control (including spraying) provides employment to youth and adult males
VMG issues and concerns in development and dissemination, adoption and scaling up	 Limited involvement of VMGs in the planning stage VMGs may not be able to attend training session called regularly
VMG related opportunities	 Available booking opportunities for record keeping in key production nodes Access to record due to regular availability
E: Case studies/profiles of success sto	ories
Success stories from previous similar projects	Enthusiastic growers of high yielding cashew varieties (including new clones) have been keen to share their success
Application guidelines for users	Training factsheets, extension leaf-lets, and post-harvest handling manuals are available
F: Status of TIMP Readiness (1. Ready for up scaling, 2, Requires validation, 2. Requires further research)	2. Requires validation
G: Contacts	
Contacts	Institute Director, ICRI, KALRO Mtwapa
Lead organization and scientists	KALRO: F. Muniu, D. Kengo
Partner organizations and contacts	

• Adoption of business plan approach by the cashew farmers

2.12.2 Collective marketing

TIMP Name	Collective marketing
Category(technology, innovation or	Management practice
management practice)	
A: Description of the technology, innovation or management practice	
Problem addressed	Individual farmer marketing of cashew increases inaccessibility
	to markets due to low volumes and low prices
What is it? (TIMP description)	A collective marketing approach entails marketing as a group.
	It involves formation of a group of farmers with an objective of
	reducing market inaccessibility.
Justification	Due to small-scale farming of cashews, marketing as a group
	would enable farmers to gain from economies of scale. The
	advantages of collective marketing are bigger volumes, uniform

	quality, reliable sellers, reliable buyers, continuous supply,		
B: Assessment of dissemination and	nd scaling up/out approaches		
Users of TIMP	Farmers, agripreneurs, traders, processing industries, extension		
	service, NGOs, research institutions		
Approaches to be used in	• Use of on-farm demos, exhibition during field days,		
dissemination	farmer to farmer training and agricultural shows		
	• Mass media (TV and radio programs, promotional		
	materials leaflets, posters, brochures, manuals and		
	pampniets)		
	telephone applications and short message services (SMS)		
	 Regular localized meetings 		
	 Farmer field and business Schools (FFBS) 		
	Agricultural Innovation Platforms (AIP)		
	• Public and private agricultural extension services.		
Critical/essential factors for	Responsive producer community/organizations to market		
successful promotion	demand on the basis of quality and affordable quantities		
	• Availability of willing traders of the produce		
	• Acceptance of smallholder farmers to form production		
	• Investments in the production of quality tradeble volumes		
	 Acceptance of the cashew varieties by consumers 		
	 Adaptability of the cashew varieties 		
	 Availability of storage infrastructure 		
Partners/stakeholders for scaling up	• Farmers Adoption of farmers' growth strategies		
and their roles	(including formation of producer groups, marketing		
	associations and investments in cashew climate smart		
	production strategies		
	• County extension staff - Organization of farmers and		
	• NGOs – Lobbying for organization of farmers into		
	economic-operation entities for ease of service delivery		
	• Strengthening of the public-public partnership towards an		
	inputs' subsidy package to stimulate quality production		
	and cost-effective marketing		
	• Research institutions – Availing improved seeds and		
C: Current situation and future see	technical backstopping		
Counting where already promoted if	Kilifi Kwala Tana Biyar Lamu Mombasa Taita Tayata and		
any	Tharaka Nithi		
Counties where TIMPs will be up	Lamu		
scaled			
Challenges in development and	• Limited reliable market information pathways to farm-		
dissemination -	households		
	• Poor group dynamics that lead to poor group harmony		
	• Weak or non-existent stakeholder innovation platforms		
	• Ineffective raw cashew prices that do not reward farmers		

	for work put in.
	• Limited capacity to interpret policy guidelines for a
	section of the value chain players
	• Lack of effective subsidy instruments across the value
	chain
Suggestions for addressing the	• Formation of common interest groups (CIGs) which can
challenges	be grown to producer and market organizations through
	capacity
	• Stimulate and enhance CIGs operational strategy for information sharing
	• Capacity building of the groups on group dynamics, leadership and management
	• Engage farmers in identifying sources of quality seed and
	seedlings' production, nursery management and seedlings
	• Link formers to innevators for participatory learning and
	• Link farmers to innovators for participatory learning and action
	• Enhance value addition, streamline marketing channels,
	producer organizations, capacity building for better
	pricing and profit maximization
	• Engage stakeholders towards understanding the chain
	policy framework
	• Provision of stimulating subsidy instruments in
Lassons last in up scaling if	There are limited suggests stories in eachery marketing
Lessons learned in up scaling in	 There are finited success stories in cashew marketing. Prices keep fluctuating as buyers also keep changing
Social environmental policy and	 Social conditions accentability by the farmers group
market conditions necessary for	dynamics issues including leadership and information
development and up-scaling	sharing under cultural networks
de verophient and up searing	 Environmental conditions and enhancing natural resource
	management
	 Observing the health safety and environmental guidelines
	policy
	• Leverage on government policies that encourage pooled
	marketing of produce
D: Economic, gender, vulnerable a	nd marginalized groups (VMGs) considerations
Basic costs	To be determined
Estimated returns	At the farm level, the price per kilogram is KES 50. Based on
	KALRO varieties of cashew, the production is 1,680kg per
	acre Therefore the returns per acre is KES 84,000 per year
Gender issues and concerns in	• Development and dissemination – Differences in
development and dissemination,	acceptance and practicing of the business exist among
adoption and scaling	youth, females and males based on the labor intensity of
	the tasks. Men and youth take lead in accessing, adopting
	and scaling/sharing of market related management
	practices
Gender related opportunities	• Production opportunities by youth, females and males in
	the production of cashew especially in nursery
	establishments and seedling production for cashew

	• Pests' and diseases control (including spraying) provides
VMG issues and concerns in development and dissemination, adoption and scaling up VMG related opportunities	 employment to youth and adult males Limited involvement of VMGs in the market linkage models Limited access to seed and information on production techniques Available employment opportunities in the nursery management and seedlings production node Access to inputs and finished products' markets through high a set of the set of
E: Case studies/profiles of success s	tories
Success stories from previous similar projects Application guidelines for users	High yielding cashew varieties (including new clones) available in Lamu and Mtwapa cashew mother-block Training factsheets, extension leaf-lets, and post-harvest
F: Status of TIMP Readiness (1. Ready for up scaling, 2, Requires validation, 2. Requires further research)	2. Requires validation
G: Contacts	
Contacts	Institute Director, ICRI, KALRO Mtwapa
Lead organization and scientists	KALRO: Muniu F., Kengo D.
Partner organizations and contacts	

- Group dynamics
 Improvement in market access

2.12.3	Profitability	analysis
2.12.3	Promability	analysis

TIMP Name	Profitability analysis	
Category (technology, innovation or	Management practice	
management practice)		
A: Description of the technology, innovation or management practice		
Problem addressed	Lack of profitability analysis by farmers, leading to lack of	
	comparison of costs and returns, poor cashew business	
	performance and low farmers' income	
What is it? (TIMP description)	Profitability analysis involves recording of costs and returns and	
	therefore determination of profit which indicates the performance	
	of the cashew agro enterprise	
Justification	Profitability analysis reviews the management success and	
	sustainability of the cashew business. It indicates areas of	
	adjustment	
B: Assessment of dissemination and scaling up/out approaches		
Users of TIMP	Farmers, agripreneurs, traders, processors, extension service	
Approaches to be used in	• Use of on-farm demos, exhibition during field days, farmer	
dissemination	to farmer training and agricultural shows	

	• Mass media (TV and radio programs, promotional materials
	leaflets posters brochures manuals and namphlets)
	• Use of digital platforms comprising web materials mobile
	telephone applications and short message services (SMS)
	Regular localized meetings
	• Farmer field and business Schools (FFBS)
	• Agricultural Innovation Platforms (AIP)
	 Public and private agricultural extension services.
Critical/essential factors for	Production programme
successful promotion	Availability of data on quantities of inputs requirements, costs
1	(purchase and transaction costs), outputs and prices
Partners/stakeholders for scaling up	• Farmers – Defining production programme and participating
and their roles	in the training
	 County extension staff - Canacity building of the stakeholders
	 NGOs Funding and mobilizing the farmers for capacity
	building
	• KALPO Conduct training of trainers
C: Current situation and future	scaling up
Counties where already promoted if	Kyyolo and Kilifi
any	Kwale and Kinn
Counties where TIMPs will be up	Kilifi Kwale Tana River Lamu Mombasa Taita Taveta
scaled	and Tharaka Nithi
Challenges in development and	 Unwillingness of the stakeholders to train
dissemination -	 Uneconomically small business/aconomic units
	 Uneconomically small business/economic units Inadaguate information to stakeholders on the affastive
	Inadequate information to stakeholders on the effective acchevy more state and als
	Cashew marketing models
	• Inadequate market related learning pathways and platforms
	(including best-bet profit maximization models).
Suggestions for addressing the	• Formation of CIGs and producer/market organizations to
chanenges	lobby farmer
	• Enhancing the producer organization concept
	• Establish learning pathways and platforms; the farmer
T 1 1 1 1 1 1 1 1 1 1	field and business school (FFBS) approach
Lessons learned in up scaling if	A few groups exposed to record keeping lessons in Kwale and Kilifi could easily track their each environment and
any Social environmental notice and	Kinn could easily track their casnew business performances
social, environmental, policy and	• Social conditions – acceptability by the farmers, group
development and up scaling	dynamics issues including leadership and information
development and up-scamig	snaring under cultural networks
	• Environmental conditions and enhancing natural resource
	management
	• Observing the health safety and environmental guidelines
D: Economic gender vulnerable a	nd marginalized groups (VMCs) considerations
Degia agota	To be determined
Dasic costs	
Estimated returns	At the farm level, the price per Kilogram is KES 50. Based on
	KALKO varieties of casnew, the production is 1,680kg per acre
Conden inner and	Therefore the returns per acre is KES 84,000 per year
Gender issues and concerns in	• women and youth have a significant contribution in cashew

development and dissemination, adoption and scaling	 labour flows especially nursery/seedlings management, weeding, nuts collection and sorting. Males have an upper hand in business planning including participation in marketing workshops Adoption and scaling – Involvement of youth, females and males 	
Gender related opportunities	Implementation of production and marketing opportunities in cotton by youth, females and males.	
VMG issues and concerns in	Failure to make adequate arrangements incorporating	
development and dissemination,	VMGs in marketing planning and dissemination issues	
adoption and scaling up		
VMG related opportunities	Opportunities exist in processed products marketing	
E: Case studies/profiles of success stories		
Success stories from previous	A few groups exposed to record keeping lessons in Kwale and	
similar projects	Kilifi could easily track their cashew business performances	
Application guidelines for users	Training factsheets, manuals and extension leaf-lets to be developed	
F: Status of TIMP Readiness (1.	1. Ready for up-scaling	
Ready for up scaling, one self-		
calculating costs, revenues and		
gross margins' analyses software		
module to be developed and		
promoted)		
G: Contacts		
Contacts	Institute Director, ICRI-KALRO Mtwapa	
Lead organization and scientists	KALRO: Muniu F., Kengo D.	
Partner organizations and contacts	KIPPRA, Tegemeo Institute	

- Profitable opportunities
 Factors affecting the profitability

2.12.4 Market Research

TIMP Name	Market Research
Category (technology, innovation or	Management practice
management practice)	
A: Description of the technology, inno	wation or management practice
Problem addressed	Lack of information that assist in effective marketing of
	produce among the smallholder farmers
What is it? (TIMP description)	Market research gathers information on the product buyer,
	demand, type required, minimum volume purchased,
	collective marketing volume, quality, packaging
	requirements, frequency of delivery, purchase price, means of
	payment and willing to buy from local farmers.
Justification	Market research enables the smallholder farmers get vital
	information about the market dynamics before their
	participation. As a result, they prepare better in order to gain

	more.
B: Assessment of dissemination and so	caling up/out approaches
Users of TIMP	Farmers, agripreneurs, traders, processors and extension
	service
Approaches to be used in dissemination	 Use of on-farm demos, exhibition during field days, farmer to farmer training and agricultural shows Mass media (TV and radio programs, promotional materials leaflets, posters, brochures, manuals and pamphlets) Use of digital platforms comprising web materials, mobile telephone applications and short message services (SMS) Regular localized meetings Farmer field and business Schools (FFBS) Agricultural Innovation Platforms (AIP) Public and private agricultural extension services.
critical/essential factors for successful	Production programme of the crop
promotion	 Availability of data on quantities of inputs requirements, costs (purchase and transaction costs), outputs and prices Becent product prices in nearby markets
Partners/stakeholders for scaling up	 Farmers – Defining production programme and
and their roles	participating in the training
	 County extension staff - Capacity building of the stakeholders
	 NGOs –Funding and mobilizing the farmers for capacity building
	KALRO - Conduct training of trainers
C: Current situation and future scalin	g up
Counties where already promoted if any	Kwale and Kilifi
Counties where TIMPs will be up scaled	Kilifi, Kwale, Tana River, Lamu, Mombasa, Taita Taveta and Tharaka Nithi
Challenges in development and	• Unwillingness of the stakeholders to train
dissemination -	Uneconomically small business/economic units
	 Inadequate information to stakeholders on the effective cashew marketing models
	• Inadequate market related learning pathways and
	platforms (including best-bet profit maximization models).
	• Inadequate market related learning pathways and platforms (including best-bet profit maximization models)
Suggestions for addressing the challenges	• Formation of CIGs and producer/market organizations to lobby farmer
	• Enhancing the producer organization concept
	• Establish learning pathways and platforms; the
	farmer field and business school (FFBS) approach

Lessons learned in up scaling if any	• A few groups exposed to record keeping lessons in Kwale and Kilifi could easily track their cashew business performances
Social, environmental, policy and market conditions necessary for development and up-scaling	 Social conditions – acceptability by the farmers, group dynamics issues including leadership and information sharing under cultural networks Environmental conditions and enhancing natural resource management Observing the health safety and environmental guidelines policy
D: Economic, gender, vulnerable and	marginalized groups (VMGs) considerations
Basic costs	To be determined
Estimated returns	• At the farm level, the price per kilogram is KES 50 . Based on KALRO varieties of cashew, the production is 1,680kg per acre Therefore the returns per acre is KES 84,000 per year
Gender issues and concerns in development and dissemination, adoption and scaling	 Women and youth have a significant contribution in cashew labour flows especially nursery/seedlings management, weeding, nuts collection and sorting. Males have an upper hand in business planning including participation in marketing workshops Adoption and scaling – Involvement of youth, females and males.
Gender related opportunities	• Implementation of production and marketing opportunities in cotton by youth, females and males.
VMG issues and concerns in development and dissemination, adoption and scaling up	No adequate arrangements incorporating VMGs in marketing planning and dissemination issues
VMG related opportunities	Opportunities exist in processed products marketing
E: Case studies/profiles of success stor	ies
Success stories from previous similar projects	A few groups exposed to record keeping lessons in Kwale and Kilifi could easily track their cashew business performances
Application guidelines for users	Training factsheets, manuals and extension leaf-lets to be developed
F: Status of TIMP Readiness (1. Ready for up scaling, one self- calculating costs, revenues and gross margins' analyses software	1 Ready for up-scaling
module to be developed and promoted)	
G: Contacts	
Contacts	Institute Director, ICRI-KALRO Mtwapa
Lead organization and scientists	KALRO: Muniu F., Kengo D.
Partner organizations and contacts	KIPPRA, Tegemeo Institute

- Market intelligence in markets
 Impact of market research

TIMP Name		Contracted production model
Category (t	technology,	Management practice
innovation or manager	ment practice)	
A: Description of the	technology, in	novation or management practice
Problem addressed		Market failure in cashew production has led to low price, low
		production and poor quality,
What is it? (TIMP deso	cription)	Contract farming is the investment by the private companies,
		inputs and technical assistance. Under contract farming terms
		contractors commit themselves to buy the entire produce at an
		agreed price. On the other hand, producers commit to provide
		the desired produce at the right quality for sale.
Justification		Contract farming commits the farmer to produce a certain
		commodity at a certain time for an agreed price and, in return,
		the contractor undertakes to buy the commodity, and may
		provide agricultural extension and other services to producers
		in order to satisfy production requirements in terms of quality
		and quantity. The benefits of contract farming to farmers are
		fluctuations credit and financial intermediation timely
		provision of inputs monitoring and labour incentives
		reduction of production risk introduction of higher-value
		crops, improved collective bargaining, household spill-over
		benefits and improved access to extension. A written contract
		farming is recommended.
B: Assessment of diss	semination and	l scaling up/out approaches
Users of TIMP		Farmers, traders, processors
Approaches to be used	in	• Use of on-farm demos, exhibition during field days,
dissemination		farmer to farmer training and agricultural shows
		• Mass media (TV and radio programs, promotional
		materials leaflets, posters, brochures, manuals and
		pamphlets)
		• Use of digital platforms comprising web materials,
		mobile telephone applications and short message services (SMS)
		Regular localized meetings
		• Farmer field and business Schools (FFBS)
		Agricultural Innovation Platforms (AIP)
		• Public and private agricultural extension services.
Critical/essential factor	rs for	• Availability of investor with production, marketing and
successful promotion		management know how
		• Willing farmers able to adhere to contract terms to
		produce for the preferred contractor

2.12.5 Contracted production model

	• Ability of the contractor to organize for farm services
	and inputs in adequate amount throughout the season to
	achieve a crop
	• Willing contracted farmers who produce under guidance
	for the preferred contractor for the agreed period.
Partners/stakeholders for scaling up	• Farmers – Defining production programme and
and their roles	participating in the training
	 County extension staff - Capacity building of the
	stakeholders
	• NGOs – Funding and mobilizing the farmers for capacity
	huilding
	• KALRO - Conduct training of trainers
	 Willing contracting company with the necessary resources
	and plans to support a sizeable group of farmers to produce
	for periods
C: Current situation and future sca	aling up
Counties where already promoted if	Kwale and Kilifi
anv	
Counties where TIMPs will be up	Kilifi, Kwale, Tana River, Lamu, Mombasa, Taita Taveta and
scaled	Tharaka Nithi
Challenges in development and	Uneconomically small business/economic units
dissemination -	• Inadequate information to stakeholders on the effective
	cashew marketing models
	Lack of trust on new contractors
	• Unwilling farmers with a long learn curve
	• Inadequate market related learning nathways and
	platforms (including best-bet profit maximization
	models)
Suggestions for addressing the	• Formation of CIGs and producer/market organizations
challenges	 Enhancing the producer organization concept
	• Establish learning nathways and platforms: the farmer
	field and business school (FFBS) approach
Lessons learned in up scaling if	• A few groups exposed to record keeping lessons in
anv	Kwale and Kilifi could easily track their cashew business
	performances
Social, environmental, policy and	• Social conditions – acceptability by the farmers, group
market conditions necessary for	dynamics issues including leadership and information
development and up-scaling	sharing under cultural networks
	• Environmental conditions and enhancing natural
	resource management
	• Observing the health safety and environmental
	guidelines policy
D: Economic, gender, vulnerable a	nd marginalized groups (VMGs) considerations
Basic costs	To be determined
Estimated returns	At the farm level, the price per kilogram is KES 50. Based on
	KALRO varieties of cashew, the production is 1.680kg per
	acre Therefore the returns per acre is KES 84.000 per year
Gender issues and concerns in	• Women and youth have a significant contribution in

development and dissemination, adoption and scaling	 cashew labour flows especially nursery/seedlings management, weeding, nuts collection and sorting. Males have an upper hand in business planning including participation in marketing workshops Adoption and scaling – Involvement of youth, females and males 	
Gender related opportunities	Implementation of production and marketing opportunities in cotton by youth, females and males.	
VMG issues and concerns in development and dissemination, adoption and scaling up	No adequate arrangements incorporating VMGs in marketing planning and dissemination issues	
VMG related opportunities	Opportunities exist in processed products marketing	
E: Case studies/profiles of success stories		
Success stories from previous similar projects	A few groups exposed to record keeping lessons in Kwale and Kilifi could easily track their cashew business performances	
Application guidelines for users	Training factsheets, manuals and extension leaf-lets to be developed	
F: Status of TIMP Readiness (1. Ready for up scaling, one self- calculating costs, revenues and gross margins' analyses software module to be developed and promoted)	1. Ready for up-scaling	
G: Contacts		
Contacts	Institute Director, ICRI-KALRO Mtwapa	
Lead organization and scientists	KALRO: Muniu F., Kengo D.	
Partner organizations and contacts	KIPPRA, Tegemeo Institute	

- 1. Productivity improvement
- 2. Impact of contracted production on welfare among farmers
- 3. Market access among farmers

2.12.6 Marketing Innovation Model

TIMP Name	Marketing Innovation model
Category (technology, innovation or	Management practice
management practice)	
A: Description of the technology, ir	novation or management practice
Problem addressed	Farmers' failure to apply entrepreneurship while marketing
	cashew leading to low prices,
What is it? (TIMP description)	An entrepreneur farmer undertakes innovations and finance and
	business acumen in an effort to transform innovations into
	economic goods and ultimately profit.
Justification	Marketing innovation encourages product diversification. With
	the diversification, Diversification develops various marketing
	channels Failure to apply innovation in marketing of cashew,

	the market outlook will be narrow
B: Assessment of dissemination and	l scaling up/out approaches
Users of TIMP	Farmers, agripreneurs, traders, processors
Approaches to be used in dissemination Critical/essential factors for	 Use of on-farm demos, exhibition during field days, farmer to farmer training and agricultural shows Mass media (TV and radio programs, promotional materials leaflets, posters, brochures, manuals and pamphlets) Use of digital platforms comprising web materials, mobile telephone applications and short message services (SMS) Regular localized meetings Farmer field and business Schools (FFBS) Agricultural Innovation Platforms (AIP) Public and private agricultural extension services.
successful promotion	 Availability of data on quantities of inputs requirements, costs (purchase and transaction costs), outputs and prices
Partners/stakeholders for scaling up and their roles	 Farmers – Defining production programme County extension staff - Capacity building NGOs – Capacity building Research teams- Fine tune the innovation model
C: Current situation and future sca	aling up
Counties where already promoted if any Counties where TIMPs will be up	Kwale and Kilifi Kilifi, Kwale, Tana River, Lamu, Mombasa, Taita Taveta and
scaled	Tharaka Nithi
Challenges in development and dissemination -	 Stakeholders' fragmentation Uneconomically small business/economic units Inadequate information to stakeholders on the effective cashew marketing models
	• Inadequate market related learning pathways and platforms (including best-bet profit maximization models)
Suggestions for addressing the challenges	 Formation of CIGs and producer/market organizations Enhancing the producer organization concept Establish learning pathways and platforms; the farmer field and business school (FFBS) approach
Lessons learned in up scaling if	A few groups exposed to record keeping lessons in Kwale and
any Social, environmental, policy and market conditions necessary for development and up-scaling	 Klift could easily track their cashew business performances Social conditions – acceptability by the farmers, group dynamics issues including leadership and information sharing under cultural networks Environmental conditions and enhancing natural resource management Observing the health safety and environmental guidelines policy
D: Economic, gender, vulnerable a	nd marginalized groups (VMGs) considerations
Basic costs	To be determined
Estimated returns	At the farm level, the price per kilogram is KES 50 . Based on KALRO varieties of cashew, the production is 1,680kg per

	acre. Therefore the returns per acre is KES 84,000 per year	
Gender issues and concerns in development and dissemination, adoption and scaling	 Women and youth have a significant contribution in cashew labor flows especially nursery/seedlings management, weeding, nuts collection and sorting. Males have an upper hand in business planning including participation in marketing workshops Adoption and scaling – Involvement of youth, females and males 	
Gender related opportunities	Implementation of production and marketing opportunities in cotton by youth, females and males.	
VMG issues and concerns in	No adequate arrangements incorporating VMGs in	
development and dissemination,	marketing planning and dissemination issues	
adoption and scaling up		
VMG related opportunities	Opportunities exist in processed products marketing	
E: Case studies/profiles of success stories		
Success stories from previous	A few groups exposed to record keeping lessons in Kwale and	
similar projects	Kilifi could easily track their cashew business performances	
Application guidelines for users	Training factsheets, manuals and extension leaf-lets to be developed	
F: Status of TIMP Readiness (1.	1. Ready for up-scaling	
Ready for up scaling, one self-		
calculating costs, revenues and		
gross margins' analyses software		
module to be developed and		
promoted)		
G: Contacts		
Contacts	Institute Director, ICRI-KALRO Mtwapa	
Lead organization and scientists	KALRO: F. Muniu, D. Kengo	
Partner organizations and contacts	KIPPRA, Tegemeo Institute	

GAPS Further research

- Channels of innovation
- Adoption of innovation marketing

TIMP Name	Internet/mobile marketing
Category (technology, innovation or management practice)	Management practice
A: Description of the technology, inno	vation or management practice
Problem addressed	Limited use of technologies among the smallholder farmers while linking to markets, leading to poor market access and constraints in marketing channels, skills and market information
What is it? (TIMP description)	Internet/mobile marketing refers to the online marketplace that provides buyers and sellers with an avenue platform to

2.12.7 Internet/Mobile Marketing

	interact and exchange goods and services These include	
	online platforms, tools, and content delivery systems.	
Justification	Internet/mobile marketing is increasingly a basic necessity for most businesses. This high adaptability of	
	internet/mobile marketing benefit businesses by providing	
	the farmer insights in the experiences of their consumers.	
	With this information farmers can attend to consumers	
	feedback and thereby improve their produce through	
	presentation and enhanced production.	
B: Assessment of dissemination and so	caling up/out approaches	
Users of TIMP	Farmers, agripreneurs, traders, processors	
Approaches to be used in dissemination	• Use of on-farm demos, exhibition during field days, farmer to farmer training and agricultural shows	
	 Mass media (TV and radio programs, promotional materials leaflets, posters, brochures, manuals and pamphlets) 	
	 Use of digital platforms comprising web materials, mobile telephone applications and short message services (SMS) 	
	Regular localized meetings	
	• Farmer field and business Schools (FFBS)	
	• Agricultural Innovation Platforms (AIP)	
	• Public and private agricultural extension services.	
Critical/essential factors for successful	• Effective online platform acceptable to farmers.	
promotion	consumers and extension service	
r	 Production programme to interest consumers on when to 	
	evpect produce	
	• Availability of online commodity platforms on social	
	 Availability of online continuouty platforms on social modio such as Easebook (Mote) 	
	Ausilability of data on supertition of inputs	
	• Availability of data on quantities of inputs	
	requirements, costs (purchase and transaction costs),	
	outputs and prices	
Partners/stakeholders for scaling up and their roles	• Farmers – Defining production programme to forecast time of sales	
	County extension staff Conscity building	
	County extension starr - Capacity building	
	 NGOS – Capacity building Formany CICs to initiate formation of online commodity 	
	 Farmers CIGs – to initiate formation of online commodity platforms 	
C: Current situation and future scaling up		
Counties where already promoted if any	Kwale and Kilifi	
Counties where TIMPs will be up scaled	Kilifi, Kwale, Tana River, Lamu, Mombasa, Taita Taveta and Tharaka Nithi	
Challenges in development and	Low internet penetration	
dissemination -	 Low internet penetration High costs of data for internet access 	
	Ingli costs of data for internet access	
	• Poor interaction of group members in the platform	
	 Inadequate information to stakenoiders accessing the platforms 	

Suggestions for addressing the challenges	 Formation of CIGs and producer/market organizations Lobby for low-cost telephone to enhance internet 	
<u> </u>	penetration	
	• Lobby for telecos for low-cost data packages for	
	internet access	
	• Develop clear rules to encourage good interaction of group members in the platform	
	 Inadequate information to stakeholders accessing the 	
	platforms	
Lessons learned in up scaling if any	• A few groups exposed to record keeping lessons in	
	Kwale and Kilifi could easily track their cashew	
	business performances	
Social, environmental, policy and market conditions necessary for	• Social conditions – acceptability online presence by the farmers in their commodity groups	
development and up-scaling	Environmental conditions should include specifying	
	their produce, the produce/service they have or are	
	requesting and their locations in the region	
	• Market conditions should include stating of prices of	
	their produce per unit. • Deliev compaigns should be guide by knowledge on	
	• Poncy campaigns should be guide by knowledge on what already exists	
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations		
Basic costs	To be determined	
Estimated returns	At the farm level, the price per kilogram is KES 50. Based	
	on KALRO varieties of cashew, the production is 1,680kg	
	per acre Therefore the returns per acre is KES 84,000 per	
Gender issues and concerns in	• Women and youth have a significant contribution in	
development and dissemination,	cashew labor flows especially nursery/seedlings	
adoption and scaling	management, weeding, nuts collection and sorting.	
	Males have an upper hand in business planning	
	Adoption and scaling Involvement of youth females	
	and males	
Gender related opportunities	• Implementation of production and marketing	
	opportunities in cotton by youth, females and males.	
VMG issues and concerns in	Adequate arrangements incorporating VMGs	
adoption and scaling up	in marketing planning and dissemination	
VMG related opportunities	Opportunities exist in online sales for processed	
	products marketing	
E: Case studies/profiles of success stories		
Success stories from previous similar	A few groups exposed to record keeping lessons in Kwale	
projects	and Kilifi easily track their cashew business performances	
Application guidelines for users	Training factsheets, manuals and extension leaf-lets to be	
Appreation guidennes for users	developed	
F: Status of TIMP Readiness (1.	1. Ready for up-scaling	

Ready for up scaling, one self- calculating costs, revenues and gross margins' analyses software	
module to be developed and promoted)	
G: Contacts	
Contacts	Institute Director, ICRI-KALRO Mtwapa
Lead organization and scientists	KALRO: Muniu F., Kengo D.
Partner organizations and contacts	KIPPRA, Tegemeo Institute

1. Factors affecting mobile marketing

2.13 Agricultural Policy Options

TIMP Name	National Agricultural policy strategy framework
Category(i.e. technology	Management practice
innovation or management practice)	management practice
A: Description of the technology, innovati	on or management practice
Problem addressed	Market failure in influencing the behaviour of cashew
	production
What is it? (TIMP description)	A policy towards the agricultural sector as a whole, or
	towards one particular interest group such as food
	consumers, grain producers, cashew producers or
	fertilizer manufacturers can be characterized as
	consisting of three sets of elements; objectives,
	instruments of policy and rules for operating
	instruments of policy.
Justification	Agricultural policies for supporting cashew output are
	based at farm and market levels. The policy's objective
	is to increase cashew output. The policy's instruments
	chosen might be to raise the price of cashew received
	by producers, such as an import tax or a production
	subsidy, an instrument to reduce the cost of grain
	and an instrument which reduces returns to products
	which compete cashew for land thus causing
	substitution of resources into cashew production
B: Assessment of dissemination and scalin	ng up/out approaches
Users of TIMP	Farmers, traders, Agripreneurs, Research institutions,
	Processing industries, Extension, NGOs
Approaches to be used in	• Farmer Field and Business School (FFBS)
dissemination	• Agricultural innovation platforms (AIP)
	• Demonstrations – On-farm and on station
	Agricultural shows/exhibitions/field days
	• Trainings - workshops/Seminars/Meetings
	• Public and private Extension Agents
	• Farmer to farmer extension models
	• Mass media – Electronic and print
	• Publications - posters/brochures/leaflets,
	manuals
	• Digital platforms – website, dashboards, Apps,
	social media short message service
Critical/essential factors for successful	• Availability of stakeholders
promotion	• Availability of agricultural policies and
	specific cashew-based policies
	• Issues in cashew business
	Specific policy objective statement
Partners/stakeholders for scaling up and	• Farmers – Demanding cashew policies to

2.13.1 National Agricultural Policy Strategy Framework

their roles	 support production and marketing County extension staff - Sensitization of farmers NGOs – Sensitization of farmers Private sector (local traders and exporters) – Demanding cashew policies to support production and marketing Research institutions – Sensitization of stakeholders
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMPs will be up scaled	All Counties where cashew farming is an important activity
Challenges in dissemination and development Suggestions for addressing challenges	 Disorganization and scattered farmers Small-scale farming Inadequate information to stakeholders on the agricultural policies whether National or County Poorly established cashew value chain Cashew production is specific to agroecological zones and not all the Counties in Kenya grow cashew Formation of producer organizations as an institution Policies for increasing productivity
	 Sensitization of stakeholders strengthening cashew value chain Diversification of cashew
Lessons learned in up scaling if any	None
Social, environmental, policy and market conditions necessary for development and up-scaling	 Social conditions – Acceptability of the policies Environmental conditions – lack of a comprehensive land use policy Policy conditions – Lacking specific cashew policy Market conditions - Poor market infrastructure
D: Economic, gender, vulnerable and marg	ginalized groups (VMGs) considerations
Basic costs	To be determined
Estimated returns	At the farm level, the price per kilogram is KES 50 . Based on KALRO varieties of cashew, the production is 1,680kg per acre Therefore the returns per acre is KES 84,000 per year
Gender issues and concerns in development and dissemination, adoption and scaling Gender related opportunities	 Development and dissemination – Supporting female and male youth, both in production and marketing cashews Adoption and scaling – Supporting female and male youth in production and marketing cashews Supporting female and male youth, both in

	the production and marketing of cashews.
	• Increased income by female and male youth
	 Increased employment by female and male
	vouth
VMC issues and concerns in development	Development and discomination in access
and discomination adaption and appling up	• Development and dissemination – in access
and dissemination, adoption and scaling up	to markets by VMGs
	• Adoption and scaling up - in access to markets
	by VMGs
VMG related opportunities	 Supporting VMGs in the production and
	marketing of cashews.
	Increased income by VMGs
	 Increased employment by VMGs
E: Case studies/profiles of success stories	
Success stories from previous	None
similar projects	
Application guidelines for users	Training factsheets, manuals and power point
	slides are available
F: Status of TIMP Readiness	
TIMP Readiness (1. Ready for up scaling,	2. Requires validation
2, Requires validation, 3. Requires further	
research)	
G: Contacts	
Contacts	The Institute Director
	ICRI-KALRO Mtwapa
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	Tegemeo Institute – info@tegemeo.org

- 1. Adoption of policy options
- 2. Equity distribution among the stakeholders
- 3. Productivity levels among the smallholder farmers due to farmer-market linking models
- 4. Farmer accessibility to production inputs

	2.13.2	County Integrate	ed Developmen	t Planning
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TIMP Name	County Integrated Development Planning
Category (i.e. technology,	Management practice
Innovation or management	
practice)	
A: Description of the technology,	innovation or management practice
Problem addressed	Lack of centralizing the smallholder agency and voices in
	planning agricultural development issues in Kenya
What is it? (TIMP description)	The County Integrated Development Planning is building a plan
	for each county in Kenya to be implemented in five years. The
	planning process is participatory, involving the development
	stakeholders in the county. It is during this planning period

	where the issues in cashew production, marketing and processing	
	are considered.	
Justification	Failure to consider cashew issues during planning would lead to	
	omission in the development funding.	
B: Assessment of dissemination a	and scaling up/out approaches	
Users of TIMP	• Farmers, traders, research institutions, processing	
	industries, extension, NGOs	
Approaches to be used in	• Farmer Field and Business School (FFBS)	
Dissemination	Agricultural innovation platforms (AIP)	
	• Demonstrations – On-farm and on station	
	• Agricultural shows/exhibitions/field days	
	• Trainings - workshops/Seminars/Meetings	
	Public and private Extension Agents	
	• Farmer to farmer extension models	
	• Mass media – Electronic and print	
	• Publications - posters/brochures/leaflets, manuals	
	• Digital platforms – website, dashboards, Apps, social	
	media short message services	
Critical/essential factors for	Availability of stakeholders	
successful promotion	• Availability of agricultural policies and specific	
	cashew-based policies	
	Issues in cashew business promotion	
	Specific policy objective statement	
Partners/stakeholders for scaling	• Farmers – Demanding cashew policies to support	
up and their roles	production and marketing	
	County extension staff - Sensitization of farmers	
	 NGUS – Sensitization of farmers Drivete sector (less) traders and exporters). Demonding 	
	• Private sector (local traders and exporters) – Demanding	
	 Research institutions – Sensitization of stakeholders 	
C: Current situation and future	on and future scaling up	
Counties where already	None	
promoted if any		
Counties where TIMPs will be	All Counties where cashew farming is an important activity	
up scaled		
Challenge in dissemination	• Disorganization and scattered farmers	
Development	• Small-scale farming	
	• Inadequate information to stakeholders on the	
	Boorly established casheyy value chain	
	 Toony established cashew value chain Cashew production are specific to agro-ecological zones. 	
	and not all the Counties in Kenva grow cashew	
Suggestions addressing	Formation of producer organizations as an institution	
for challenges	Policies for increasing productivity	
	Sensitization of stakeholders	
	Strengthening cashew value chain	

	Diversification of cashew	
Lessons learned in up scaling if any	• None	
Social, environmental, policy and market conditions necessary for development and up-scaling	 Social conditions – lack of acceptability of the policies Environmental conditions – lack of a comprehensive land use policy Policy conditions – Lacking specific cashew policy Market conditions - Poor market infrastructure 	
D: Economic, gender, vulnerable	e and marginalized groups (VMGs) considerations	
Basic costs	To be determined	
Estimated returns	At the farm level, the price per kilogram is KES 50 . Based on KALRO varieties of cashew, the production is 1,680kg per acre , therefore the returns per acre is KES 84,000 per year	
Gender issues and concerns in	 Development and dissemination – Supporting females 	
development and dissemination,	and males youth, in production and marketing cashews	
adoption and scaling	 Adoption and scaling – Supporting females and males youth in production and marketing of cashews 	
Gender related opportunities	• Supporting youth, females and males in the	
	production and marketing of cashews.	
	 Increased income by females and males youth 	
	• Increased employment by females and males youth,	
VMG issues and concerns in	• Development and dissemination – in access to	
development and dissemination,	markets by VMGs	
adoption and scaling up	Adoption and scaling up - in access to markets by VMGs	
VMG related opportunities	• Supporting VMGs the production and marketing of cashews.	
	 Increased income by VMGs 	
	 Increased employment by VMGs 	
E: Case studies/profiles of success stories		
Success stories from previous similar projects	None	
Application guidelines for users	Training factsheets, manuals and power point slides are available	
F: Status of TIMP Readiness		
TIMP Readiness (1. Ready for up	Requires validation	
scaling, 2, Requires validation, 3.		
Requires further research)		
G: Contacts		
Contacts	The Institute Director,	
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	Tegemeo Institute – info@tegemeo org	

- Adoption of policy options
 Equity distribution among the stakeholders
 Productivity levels among the smallholder farmers due to farmer-market linking models

4. Farmer accessibility to production inputs

2.13.3 Instruments of policy related to cashew

TIMP Name	Instruments of policy related to cashew
Category (i.e. technology,	Management practice
Innovation or management practice))	
A: Description of the technology, in	novation or management practice
Problem addressed	Failure to implement policy objectives related to cashews
	instruments to achieve the policy
What is it? (TIMP description)	Policy instruments are the means to achieve policy objectives
Justification	Methods of attempting to achieve policy objectives may take a wide variety of forms. It is very likely that a particular policy instrument, although designed to have primarily an efficiency, distributive, or stability effect, will also have some impact on the other objectives
B: Assessment of dissemination and	l scaling up/out approaches
Users of TIMP	Farmers, Traders, Agripreneurs, Processing industries, Extension, NGOs, Research institutions
Approaches to be used in	• Farmer Field and Business School (FFBS)
dissemination	Agricultural innovation platforms (AIP)
	• Demonstrations – On-farm and on station
	• Agricultural shows/exhibitions/field days
	• Trainings - workshops/Seminars/Meetings
	• Public and private Extension Agents
	• Farmer to farmer extension models
	• Mass media – Electronic and print
	• Publications - posters/brochures/leaflets, manuals
	• Digital platforms – website, dashboards, Apps, social
	media short message services
Critical/essential factors for	Availability of policy objectives
successful promotion	Availability of policy instruments
Partners/stakeholders for scaling up	• Farmers – beneficiaries of policy instruments
and their roles	• County extension staff - Sensitization of farmers
	• NGOs – Sensitization of farmers
	• Private sector (local traders and exporters) –
	beneficiaries
C: Current situation and future see	• Research institutions – Sensitization of stakeholders
Counties where already promoted if	None
anv	None
Counties where TIMPs will be up scaled	All Counties where cashew farming is an important activity
Challenges in development and	Disorganization and scattered farmers
dissemination -	Small-scale farming

	• Inadequate information to stakeholders on the	
	agricultural policies whether National or County	
	Poorly established cashew value chain	
	• Cashews production are specific to agro-ecological	
C (Linearing the	zones and not all the Counties in Kenya grow casnews	
Suggestions for addressing the	• Formation of producer organizations as an institution	
challenges	Policies for increasing productivity	
	• Sensitization of stakeholders	
	Strengthening cashew value chain	
	Diversification of cashews	
Lessons learned in up scaling if any	• None	
Social, environmental, policy and	• Social conditions – Low understanding of policy	
market conditions necessary for	instruments	
development and up-scaling	• Environmental conditions – lack of a	
	comprehensive land use policy	
	 Policy conditions – Lacking specific cashew policy 	
	Market conditions - Poor market infrastructure	
D: Economic, gender, vulnerable a	nd marginalized groups (VMGs) considerations	
Basic costs	To be determined	
Estimated returns	• At the farm level, the price per kilogram is KES 50 .	
	Based on KALRO varieties of cashew, the production is	
	1,680 kg per acre Therefore the returns per acre is ES	
Contan income and according in	84,000 per year	
Gender issues and concerns in	• Development and dissemination – Low cashew	
adoption and scaling	Adoption and scaling Market in access by females	
adoption and scanng	• Adoption and scaling – Market in access by, remaies	
Gender related opportunities	 Production-increasing by females and males youth 	
Concertation of Postminute	 Increased resource use in agricultural production and 	
	processing by youth, women and men	
	• Sustainability in cashew farming by youth, women and	
	men	
VMG issues and concerns in	• Development and dissemination – Issues related to	
development and dissemination,	efficiency, factor markets, product markets by VMGs	
adoption and scaling up	 Adoption and scaling up - Issues related to 	
	efficiency, factor markets, product markets by	
	VMGs	
VMG related opportunities	• Efficiency and access to factor and product markets by	
	VMGs.	
	Increased income by VMGs	
	Increased employment by VMGs	
	• Sustainability	
E: Case studies/profiles of success stories		
Success stories from previous similar projects	None	
Application guidelines for users	Training factsheets, manuals and power point slides are	
	available	
F: Status of TIMP Readiness		

TIMP Readiness (1. Ready for up	2 Requires validation
scaling, 2, Requires validation, 3.	
Requires	
further research)	
G: Contacts	
Contacts	The Institute Director,
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- Validation of policy instruments
 Equity distribution among the stakeholders
- 3. Farmer accessibility to production inputs markets
- 4. Farmers' accessibility to output markets

TIMP Name	Policy cycle	
Category (i.e. technology,	Management practice	
Innovation or management		
practice)		
A: Description of the technology, innovation or management practice		
Problem addressed	Why is a policy cycle an appropriate tool for developing a new	
	policy? Policy cycle is a valuable device for new policy	
	development. It is a tool which divides complex procedures into	
	convenient and manageable steps. These individual steps provide a	
	frame work and antedates any forthcoming issues related to policy	
	development.	
What is it? (TIMP description)	The policy cycle is usually divided into five stages: agenda setting,	
	formulation, implementation, and evaluation	
Justification	The policy cycle creates the need for a policy based on the	
	agricultural problem emergence/issues. The policy cycle is an	
	idealized process that explains how policy should be drafted,	
	implemented and assessed. It serves more as an instructive guide	
	for those new to policy than as a practical strictly-defined process,	
	but many organizations aim to complete policies using the policy	
	cycle as an optimal model. The policy cycle is a valuable	
	device for new policy development. It is a tool which divides	
	complex procedures into convenient and manageable steps	
	These steps are flexible enough to incorporate any changes at	
	the time of new policy development and as a part of continuous	
	change once it is implemented	
B: Assessment of dissemination and scaling up/out approaches		
Users of TIMP	Farmers, traders, agripreneurs, processing industries, extension	
	service, NGOs, research institutions	

2.13.4 Policy cycle

Approaches to be used in	• Farmer Field and Business School (FFBS)	
dissemination	• Agricultural innovation platforms (AIP)	
	• Demonstrations – On-farm and on station	
	• Agricultural shows/exhibitions/field days	
	Trainings workshops/Seminars/Meetings	
	Dublic and private Extension A conte	
	Fublic and private Extension Agents	
	• Farmer to farmer extension models	
	• Mass media – Electronic and print	
	• Publications - posters/brochures/leaflets, manuals	
	• Digital platforms – website, dashboards, Apps, social media	
	short message services	
Critical/essential factors for	Availability of stakeholders	
successful promotion	• The stages of problem emergence, formulation, implementation and evaluation	
Partners/stakeholders for scaling	• Farmers – generate issues	
up and their roles	 County extension staff - capacity building 	
	• NGOs – capacity building	
	• Private sector (local traders and exporters) – generate issues	
C: Current situation and future	• Research institutions – capacity building	
Counting where already promoted	• None	
if any	• None	
Counties where TIMPs will be up scaled	• All Counties where cashew farming is an important activity	
Challenges in development and	 Disorganization and scattered farmers 	
dissemination -	Small-scale farming	
	• Inadequate information to stakeholders on issues	
Suggestions for addressing the	Poorly established cashew value chain	
challenges	 formation of producer organizations as an institution Address issues on accretion 	
chancinges	 Address issues on aggregation Sensitization on the roles of each policy cycle stages 	
	 strengthening cashew value chain 	
Lessons learned in up scaling if	None	
any		
Social, environmental, policy	• Gender inclusiveness in crop research and development	
and market conditions necessary	 Capacity building of stakeholders 	
for development and up-scaling	• Understanding the physical and biotic environment in	
	target ecologies	
	• Understanding community culture, preferences, and	
D: Economic, gender, vulnerable	e and marginalized groups (VMGs) considerations	
Basic costs To be determined		
Estimated returns	At the farm level, the price per kilogram is KES50 Based on	
	KALRO varieties of cashew, the production is 1.680 kg per acre	
	Therefore the returns per acre is KES 84,000 per year	
Gender issues and concerns in	• Development and dissemination – generation of issues	

development and dissemination, adoption and scaling	and implementation by the youth (females and males), in production and marketing of cashews	
	• Adoption and scaling – generation of issues and	
	implementation by the youth (females and males) in	
	production and marketing of cashews	
Gender related opportunities	• Incorporation of issues generated by the youth (females	
	and males).	
	Implementation of policy cycle	
VMG issues and concerns in	 Development and dissemination – Problems related to 	
development and dissemination,	VMGs	
adoption and scaling up	• Adoption and scaling up – implementation issues	
	related to VMGs	
VMG related opportunities	• Reduction of VMGs problems in the production and	
	marketing of cashews.	
	• Involvement of VMGs in the implementation of policy	
E: Case studies/profiles of success stories		
Success stories from previous	None	
similar projects		
Application guidelines for users	Training factsheets, manuals and power point slides are available	
F: Status of TIMP Readiness		
TIMP Readiness (1. Ready for up	2 Requires validation	
scaling, 2, Requires validation, 3.		
Requires		
further research)		
G: Contacts		
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	Tegemeo Institute – info@tegemeo.org	

- Analysis of policy model
 Impact on the new policy on cashew production and marketing



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