



D 4.1

Biophysical and economic database of case study technologies and practices

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experience into a BELT of Sustainable Intensification

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WP4

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Dissemination

Level:







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CHAPTER 1: INTRODUCTION

1.1 Background

New technologies create new patterns of resource use, for example by altering labour requirements or the cost of management inputs. A key objective of EWABELT is to see how new technologies or practices alter and impose new patterns of resource use in comparison with a current baseline, by comparing the effects on profitability and feasibility, in terms of inputs such as capital inputs, labour, and land requirement.

D4.1 biophysical and economic database of case study technologies, collects data for this evaluation, so that the impacts of the new technologies being proposed and trialled can be compared with a counterfactual that the farmers might currently use. The database, which is part of **Task 4.2** Quantification of the set of capital, land and labour requirement associated with each technology and practice (Month 8-48), will then be used to support **Task 4.3** Economic and financial modelling of new technologies and practices (Month 17-48).

1.2 Description

D4.1 is a spreadsheet database named "DS_WP4_CRAN_Biophysical and economic database_technologies_H2020_EWABELT_v1" being stored at the following location: EWA-BELT Sharing Point Platform (https://app.ewabelt.eu/drive).

Once the dataset is approved by the EC and is fully completed, it will also be made available on the EWA BELT website under the section "deliverables" (https://www.ewabelt.eu/deliverables) and uploaded to the Zenodo repository and related locations as explained in the Data Management Plan second version (D.1.8).

It contains the following data from the following countries as shown in Table 1:

Table 1: Country, crop, and partner with data so far included in D4.1

Country	Crop	Partner
Ghana	Maize	KDC
Glialia	Fonio	RDC
	Cotton	
Burkina Faso	Sorghum	UNB/INERA
	Maize	
	Maize	
	Groundnut	KALRO
Kenya	Finger millet	
	Groundnut varieties	UON
	Maize	UON







In Ghana, Kundok Development Consult (KDC) has been recording data on the following technologies;

- Integrated Soil Fertility Management (ISFM) in maize
- Water management (Bunding in maize)
- Fonio intercropping with Legumes

In Burkina Faso, The Institut de l'Environnement et de Recherches Agricoles (INERA) and the Université Nazi BONI (UNB) have been recording data on:

- Sorghum-cotton-mixed farming systems
- Maize-cotton-mixed farming systems
- Sole cotton farming systems

In Kenya, the Kenya Agricultural and Livestock Research Organisation (KALRO) has recorded data on:

- Integrated soil fertility management in Neglected/Underutilized crops species (Finger millet and Maize)
- Peanut rotation of with cereals
- Groundnut production with Aflasafe KE-01
- Maize production with Aflasafe KE-01
- Finger millet production with Aflasafe KE-01

Also in Kenya, the University of Nairobi (UoN) has collected data on following technologies;

• Evaluation of peanut varieties with Aflasafe

So far, **D4.1** covers the 2021 production season. **D4.1** will continue to be updated during the lifetime of the project as new project technologies are implemented and as new data is made available through further project research.





CHAPTER 2: METHOD

As part of effort to achieve these tasks, an internal meeting was organized within Cranfield to discuss the data requirement for the economic analyses being undertaken by the team considering the variance in terms of technologies been promoted by partners in East and West Africa. The challenge is in the diversity of technologies being evaluated and the different recommendation domains they represent. Identifying the appropriate means of conducting the analyses is therefore very important. The initial need for **Task 4.2** was to develop a data collection tool and circulate to partners to help them collect data needed for economic analysis having identified the relevant variables to collect data on. These however varies with different technologies.

The data tool was shared with project partners to obtain their feedback. After receiving feedback from partners, the data collection tool was finalized and shared with West African partners (KDC, CSIR-SARI, UNB, UNIMAK, INERA), and East Africa partners (HU, JU, KALRO, NM- AIST, TARI, UoN) across the six African countries in July 2021 to collect the relevant socio-economic data from their field experiments and demonstrations (see Appendix 5 for full name of partners).

Data collected included data for the following technology groupings: Neglected and underutilised crop species (**Sub-task 2.1.1**), Sustainable soil management (**Sub-task 2.1.1**), Sustainable water management (**Sub-task 2.2.2**).

Data collected from the experimental sites and on-farm trials includes information on land preparation, sowing, weeding, fertilizer applications, harvesting, threshing and bagging. Data has been collected at each stage of the farm operation as they are implemented throughout the season.





2.1 Structure of the data collection tool

The data collection tool was designed to allow for the calculation of gross output, gross margins, and net margins.

The tool has four main sections which include:

Section 1: Technology Listing

Section 2: Detail economic data collection section

Section 3: Summary economic data of each treatment of the technology

Section 4: Input market prices and exchange rate monitor

Section 1: Technology listing

This section of the tool (see Appendix 1) collects meta data on the technologies being developed or validated by each partner. It requests a brief description of the experiment, the crops under study, the work package, the project tasks and sub-tasks that the trial relates to, and the lead contact. The information collected include the following:

Metadata

- Region (East or West Africa)
- Country
- Partner
- Lead scientist
- List of technologies
- Related crops
- Work package
- Task and sub-task

Section 2: Detailed economic data collection

This section of the tool (see Appendix 2) collects further profile data (Section 2.1) and field operations, inputs and outputs data (Section 2.2):

Section 2.1: Site profile data

Profile data

- Country
- FRRU Code
- Lead Farmer code







- Task No
- Name of Partner:
- Contact person:
- Contact person email:
- Location of plot: (on-farm or on-station)
- Description of technology/protocol/method

Section 2.2: Field operations, inputs, and outputs data

1) Labour used

- Land clearing (h/ha and USD/h)
- Ploughing/ridging/etc (h/ha and USD/h)
- Sowing (h/ha and USD/h)
- Thinning/transplanting (h/ha and USD/h)
- Staking (h/ha and USD/h)
- Inorganic Fertilizer application 1 (h/ha and USD/h)
- Inorganic Fertilizer application 2 (h/ha and USD/h)
- Organic Fertilizer application (h/ha and USD/h)
- Weeding/herbicide 1 (h/ha and USD/h)
- Weeding/herbicide 2 (h/ha and USD/h)
- Manual weeding (h/ha and USD/h)
- Insecticide/pesticide application 1 (h/ha and USD/h)
- Insecticide/pesticide application 2 (h/ha and USD/h)
- Insecticide/pesticide application 3 (h/ha and USD/h)
- Harvesting (h/ha and USD/h)
- Threshing and bagging (h/ha and USD/h)

2) Input used

- Seed of crop 1 (kg/ha and USD/kg)
- Seed of crop 2 (kg/ha and USD/kg)
- InorganicFertilizer 1 (kg/ha and USD/kg)
- InorganicFertilizer 2 (kg/ha and USD/kg)
- InorganicFertilizer 3 (kg/ha and USD/kg)
- Organic fertilizer 1 (t/ha and USD/t)
- Organic fertilizer 2 (t/ha and USD/t)
- Pesticide/insecticide 1 (l/ha and USD/l)
- Pesticide/insecticide 2 (1/ha and USD/l)
- Pesticide/insecticide 3 (1/ha and USD/l)
- Weedicide/herbicide 1 (l/ha and USD/l)
- Weedicide/herbicide 2 (l/ha and USD/l)
- Weedicide/herbicide 3 (l/ha and USD/l)

3) Output obtained

• Grain crop 1 (t/ha)









- Grain crop 2 (t/ha)
- Stover crop 1 (t/ha)
- Stover crop 2 (t/ha)





Section 3: Summary economic data

This section (see Appendix 3) calculates the monetary value of the inputs and outputs on a per hectare basis, dividing these into the total value of the outputs (Section 3.1), and the total costs of the inputs (Section 3.2).

Section 3.1 Total value of output

Product and output prices

- Yield crop 1 (t/ha)
- Output price 1 (USD/t)
- Yield crop 2 (t/ha)
- Output price 2 (USD/t)
- Stover 1 (t/ha)
- Stover 2 (t/ha)
- Stover 1 price (USD/t)
- Stover 2 price (USD/t)
- Other price
- Other yield

3.2 Total cost of all inputs

Cost of land preparation

- Land clearing (USD/ha)
- Tractor Ploughing (USD/ha)
- Bullock Ploughing (USD/ha)
- harrowing (USD/ha)

Cost of Seed

Seed 1:

- Seed quantity (kg/ha)
- Certified Seed price (USD/kg)
- Cost of dibbling/drilling (USD/ha)
- Cost of planting (USD/ha)

Seed 2:

- Seed quantity (kg/ha)
- Certified Seed price (USD/kg)
- Cost of dibbling/drilling (USD/ha)







• Cost of planting (USD/ha)

Cost of Herbicides/Weedicides

- Herbicide 1:
- Quantity of herbicide 1 (kg/ha)
- Price of herbicide 1 (USD/Ltr)
- Herbicide 2:
- Quantity of herbicide 2 (kg/ha)
- Price of herbicide 2 (USD/Ltr)
- Herbicide 3:
- Quantity of herbicide 3 (kg/ha)
- Price of herbicide3 (USD/kg)

Cost of Fertilizers

- Inorganic Fertilizer 1:
- Quantity of fertilizer 1 (kg/ha)
- Price of fertilizer 1 (USD/kg)
- Inorganic Fertilizer 2:
- Quantity of fertilizer 2 (kg/ha)
- Price of fertilizer 2 (USD/kg)
- Inorganic Fertilizer 3:
- Quantity of fertilizer 3 (kg/ha)
- Price of fertilizer 3 (USD/kg)
- Organic Fertilizer 1:
- Quantity of fertilizer 3 (kg/ha)
- Price of fertilizer 3 (USD/kg)
- Organic Fertilizer 2:
- Quantity of fertilizer 3 (kg/ha)
- Price of fertilizer 3 (USD/kg)

Cost of Pesticides/insecticides

- Pesticide 1:
- Quantity of herbicide 1 (kg/ha)
- Price of herbicide 1 (USD/kg)
- Pesticide 2:
- Quantity of herbicide 2 (kg/ha)
- Price of herbicide 2 (USD/kg)
- Pesticide 3:
- Quantity of herbicide 3 (kg/ha)
- Price of herbicide3 (USD/kg)

Labour Cost (LC)

- Weed control LC (USD/ha)
- Insectice application LC (USD/ha)







- harvesting LC (USD/ha)
- Dehusking LC (USD/ha)
- Shelling/Threshing LC (USD/ha)
- Staking LC (USD/ha)
- Manual weeding LC (USD/ha)





Section 4: Input prices and exchange rate monitoring

This section (Appendix 4) captures the market prices of the inputs used in production within the FFRU where the trial/demonstrations were implemented. It also monitors the exchange rate movement within the period.

Input price data

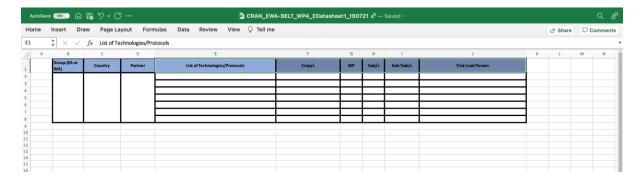
- Seed of various crops
- Inorganic fertilizers
- Organic fertilizers
- Pesticides/Insecticides
- Weedicide/Herbicides





APPENDICES

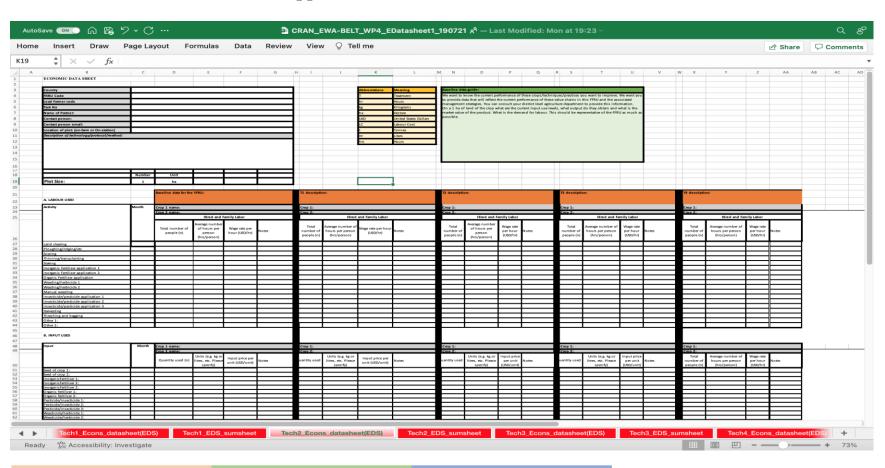
Appendix 1: Technology listing tool







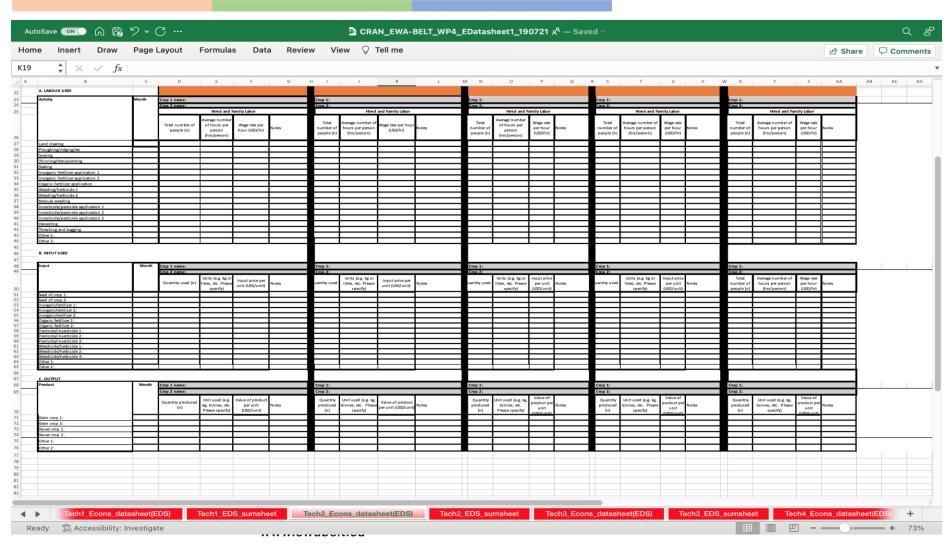
Appendix 2: Detail economic data collection tool









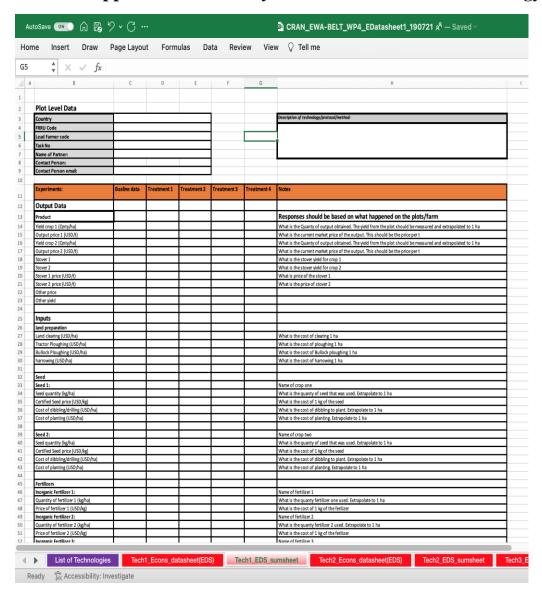








Appendix 3: Summary economic data of each technology





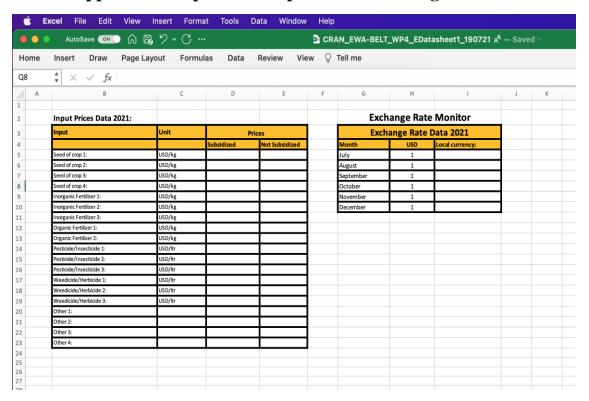


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A	× ✓ fx						
*	В	С	D	E	F	G	н
	V) //	,	U	·	-	0	n
Fertilizers		+					
Inorganic Fer	rtilizer 1:	+ +	-			_	Name of fertilizer 1
	fertilizer 1 (kg/ha)	 					What is the quanty fertilizer one used. Extrapolate to 1 ha
	lizer 1 (USD/kg)	\neg					What is the cost of 1 kg of the ferilizer
Inorganic Fer							Name of fertilizer 2
	fertilizer 2 (kg/ha)	\perp					What is the quanty fertilizer 2 used. Extrapolate to 1 ha
	lizer 2 (USD/kg)	\rightarrow		_			What is the cost of 1 kg of the ferilizer
Inorganic Fer	rtilizer 3: fertilizer 3 (kg/ha)			_			Name of fertilizer 3 What is the quanty fertilizer 3 used. Extrapolate to 1 ha
	lizer 3 (USD/kg)						What is the cost of 1 kg of the ferilizer
Organic Ferti		 					Name of organic fertilizer 1
	iertilizer 3 (kg/ha)						What is the quanty of organic fertilizer 1 used. Extrapolate to 1 ha
	lizer 3 (USD/kg)						What is the cost of 1 kg of the organic ferilizer 1
Organic Ferti							Name of organic fertilizer 2
	ertilizer 3 (kg/ha)	$\overline{}$					What is the quanty of organic fertilizer 2 used. Extrapolate to 1 ha
Price of fertil	lizer 3 (USD/kg)	-					What is the cost of 1 kg of the organic ferilizer 2
		+ +					
		 					
Herbicides/	Weedicides						
Herbicide 1:							Name of herbicide 1
	herbicide 1 (kg/ha)						What is the quanty of herbicide 1 used. Extrapolate to 1 ha
	bicide 1 (USD/Ltr)	\bot					What is the cost of 1 Ltr of the ferilizer
Herbicide 2:		\rightarrow					Name of herbicide 2
	herbicide 2 (kg/ha)	$\overline{}$		_			What is the quanty of herbicide 2 used. Extrapolate to 1 ha
Herbicide 3:	bicide 2 (USD/Ltr)	+ +	-	-			What is the cost of 1 Ltr of the ferilizer Name of herbicide 3
	herbicide 3 (kg/ha)	 					What is the quanty of herbicide 3 used. Extrapolate to 1 ha
	bicide3 (USD/kg)						What is the cost of 1 Ltr of the herbicide
Pesticides/ir		\perp					
Pesticide 1:		\rightarrow					Name of pesticide 1
	herbicide 1 (kg/ha) bicide 1 (USD/kg)			_			What is the quanty of pesticide 1 used. Extrapolate to 1 ha What is the cost of 1 Ltr of the pesticide
Pesticide 2:	sicide 1 (USD/kg)	+ +					Name of pesticide 2
	herbicide 2 (kg/ha)	 					What is the quanty of pesticide 2 used. Extrapolate to 1 ha
	bicide 2 (USD/kg)						What is the cost of 1 Ltr of the pesticide
Pesticide 3:							Name of pesticide 3
	herbicide 3 (kg/ha)	\rightarrow					What is the quanty of pesticide 3 used. Extrapolate to 1 ha
Price of herb	bicide3 (USD/kg)	\rightarrow					What is the cost of 1 Ltr of the pesticide
1-1	(t.et	++		_			
Labour Cost	(LC) of LC (USD/ha)	+ +				-	What is the cost of labour that was used to apply the herbicides. Extrapolate to 1 ha
	olication LC (USD/ha)	+ +					What is the cost of labour that was used to apply the inscribics. Extrapolate to 1 ha What is the cost of labour that was used to apply the inscribics. Extrapolate to 1 ha
harvesting LO							What is the cost of harvesting. Extrapolate to 1 ha
Dehusking Li	C (USD/ha)						What is the cost of dehusking. Extrapolate to 1 ha
Shelling/Thre	shing LC (USD/ha)						What is the cost of shelling. Extrapolate to 1 ha
Staking LC (U		\perp					What is the cost of staking. Extrapolate to 1 ha
	ding LC (USD/ha)	+					What is the cost of manual weeding. Extrapolate to 1 ha
Other LC1 Other LC2		+		-		_	
outer LCZ		_					
	ist of Technologi		Econs data			ch1_EDS_su	umsheet Tech2_Econs_datasheet(EDS) Tech2_EDS_sumsheet Te





Appendix 4: Input market prices and exchange rate monitor







Appendix 5. Full name of African partners

West African partners;

Sub-region	Country	Institution	
	Sierra	University of Makeni	UNIMAK
	Leone		
	Burkina	Institut de l'Environnement et de Recherches	INERA
	Faso	Agricoles	
W. A. C.	Burkina	Université Nazi BONI	UNB
West Africa	Faso		
	Ghana	Council for Scientific and Industrial Research	CSIR-SARI
		Savanna Agricultural Research Institute (CSIR-	
		SARI)	
	Ghana	Kundok Development Consult	KDC

East Africa partners;

Sub-region	Country	Institution	
		Hawassa University	HU
		Jimma University	JU
		Kenya Agricultural and Livestock Research	KALRO
East Africa	Foot Africa	Organisation	
Last Affica		The Nelson Mandela African Institute of Science	NM-AIST
		and Technology	
		Tanzania Agricultural Research Institute	TARI
		University of Nairobi	UoN