Assistance for Capacity Building Through Enhancing Operation of the National Agricultural Policy Center
FAO Projects GCP/SYR/006/ITA and TCP/SYR/29006 (A)

Guideline for using a PAM spreadsheet template

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Introduction:

This guideline presents a spreadsheet template under Excel initially developed by Tom Randolph at the West African Rice Development Association in collaboration with the former Food Research Institute at Stanford. This template has been extensively used to compute the comparative advantages of the rice subsector in West Africa countries in the late nineties and early year of the 2000 decade. It has also been used in the framework of the Comparative Advantages Study (CAS) of selected Syrian agro-food commodity chains implemented by the staff of the National Agricultural Policy Centre of the Syrian Ministry of Agriculture and Agrarian reform with the support of the FAO.

This document presents how to use the template to compute Policy Analysis Matrix. Readers who are not familiar with this methodology for computing indicators of comparative advantages can refer to the seminal manual of E.A Monke and S.R. Pearson[1] to get insight into the analytical foundations of the method. Another guideline derived from the CAS's experience outlines the major steps followed for implementing the method[2].

The document is organized around 4 sections:

- Section 1 introduces the structure of the spreadsheet and presents its different parts in details. A copy of the spreadsheet is provided in Appendix A if the reader cannot access to the Excel file while reading the document. If the reader whish to open the <PAM model.xls> file he should read before section 3.2 page 32.

- Section 2 explains how the PAM is computed from the data keyed in. Additional and more detailed explanations are given on the computation rationale in Appendix B.

- Section 3 provides information on how to handle the spreadsheet.

- Section 4 provides examples of possible adjustments and additional functionalities to the basic PAM template.

[1] Monke E.A. and Pearson S.R., 1989, The Policy Analysis Matrix for Agricultural Development, Cornell University Press, Ithaca.

[2] F.Lançon, 2005, Methodological guidelines for PAM Analysis, FAO Project - GCP/SYR/006/ITA and TCP/SYR/2906(A), FAO, Damascus, Syria.

1. Spreadsheet content

1.1. Spreadsheet global structure and modeling capacity.

The file <PAM model.xls> contains two spreadsheets entitled "PAM" and "Parity price"; additional spreadsheets can be added taking advantage of software functionalities to make additional computations (sensitivity analysis in particular see section 4.3and 4.4). The PAM spreadsheet is the core of the template while the Parity Price spreadsheet just assists the user in organizing the data to compute the parity price for the main final output of the representative systems analyzed.

The user should characterize the commodity chain to be analyzed along a configuration that fit along the structure of the PAM spreadsheet which can handle four budgets corresponding to commodity chain agents or steps (Figure 1):

- Farm level budget
- Farm to processor budget,
- Processing
- Processing to wholesale

While the spreadsheet can easily manage less than four agents - by leaving empty a budget that is not corresponding to any observed agent or step - the incorporation of additional budget would require a significant investment in terms of time and resources and a certain level of expertise in spreadsheet development. These four budgets encompass the major steps of agro-food chains and correspond to the standard commodity chain structure proposed by Monke and Pearson.

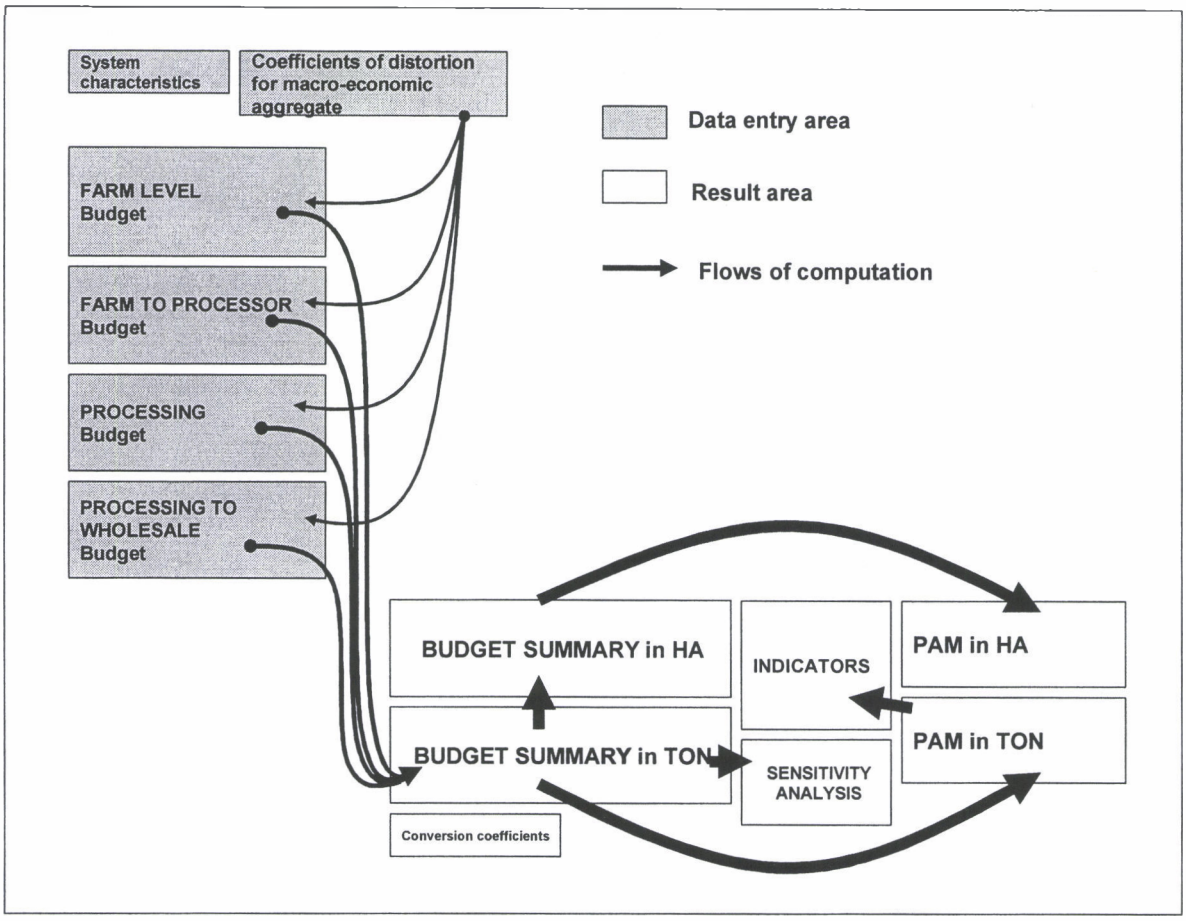
If the user wants to add additional agents without entering investing time into major modifications of the current template, he should considered aggregating operations of the same nature performed by two different agents into the same budget. For instance one budget can cover assembling and wholesale trade of for farm outputs downward to the processing unit. It should also be noted that the three post-farm budgets, following the farm level budget, can handle processing activities. Eventually, the analyst should also considered that certain processing activities performed as a service for a fee basis to another agent can be incorporated into the budget as an intermediate input, and do not necessarily call for a specific budget.

The PAM spreadsheet computes a Budget Summary by extracting the corresponding aggregated figures from each Budget. The Budget Summary is computed either in a volume basis or on a hectare basis by applying the appropriate conversion coefficients.

Two PAMs are computed from the budgets summary, one on a volume basis and another one on a hectare basis, while a table of indicators (FCB, DRC…) is computed from the PAM computed in volume. Breakeven points for various variables are computed from the Budget Summary in volume and reported in the Sensitive Analysis table

The following section presents in detail how the information is compiled and how outputs are reported in each of these tables.

Figure 1: PAM spreadsheet organization



1.2. Data organization and results presentation.

The spreadsheet has two zones:

- one for data entry corresponding to the four budgets plus the block for entering the coefficient of distortions (shaded blocks in Figure 1). Data are keyed in the shaded cell (grey color), while the "white" cells contain formula and should not be modified.

- one area providing a range of outputs in different tables (non shaded areas in Figure 1).

1.2.1. Data organization:

1.1.1.1.General information

System Characteristics – At the top left part of the spreadsheet four fields are allocated for entering information on the system characteristics (Figure 2): the main output, system name, the reference year for the computation and the version of the spreadsheet.

Tip: In addition to this information it is also advised to include the date and hours in the printing output configuration commands of Excel, to clearly distinguish the different version of the PAM computation.

Figure 2: Data entry block for system feature.

	A	B	C	D	E	F	G
1	**Policy Analysis Matrix for representative system**						
2							
3							
4	MAIN FINAL OUTPUT	lint cotton					
5	SYSTEM	network irrigated cotton large ginery					
6	REFERENCE YEAR	2001-2002					
7	VERSION:	July 2004					
8							

Coefficients of macro-economic distortion. On the top right side of the PAM spreadsheet four fields are allocated for indicating prevailing distortions affecting several factor and financial markets:

- Distortion between the observed wage level (market wage) and the one that would prevail without any policy or market induced distortions (social wage). The value keyed in is the ratio of the social wage to the private wage.
- Distortion between qualified and non-qualified labor wages. The value entered is the value of the social contribution as a percentage of the salary without contribution.
- Distortion on the capital cost induced by tax (or subsidy) on capital investment; the value is entered as a percentage.
- Distortion between the market exchange rate and the real exchange rate; the value is entered as the ratio the Social Exchange Rate above the Nominal Exchange Rate.

Figure 3 Coefficients for macro-economic distortions

	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH
1																	
2		1	Wages Discrepancies MO-NQ (Unskilled labor): [Wage at social price/wage at market price]														
3		25.8%	Taxes MO-Q (on skilled labor): [% contribution and other taxes on labor in the formal sector]														
4		0%	Taxes on K (capital): [% subsidies = -%; % taxe = +%]														
5			Taxes sur IE (les tradables inputs): [at import]														
6				ad valorem: [% on value CIF]													
7				fixed: [amount by unit of product]													
8		1.0	Discrepancy Exchange rate: [equilibrium exchange rate (reference rate)/nominal exchange rate (market exchange rate)]														

The values of the interest rate at market (private) price and at social prices are keyed in at the top of the Farm budget (Figure 4).

Figure 4 Interest rates date entry areas:

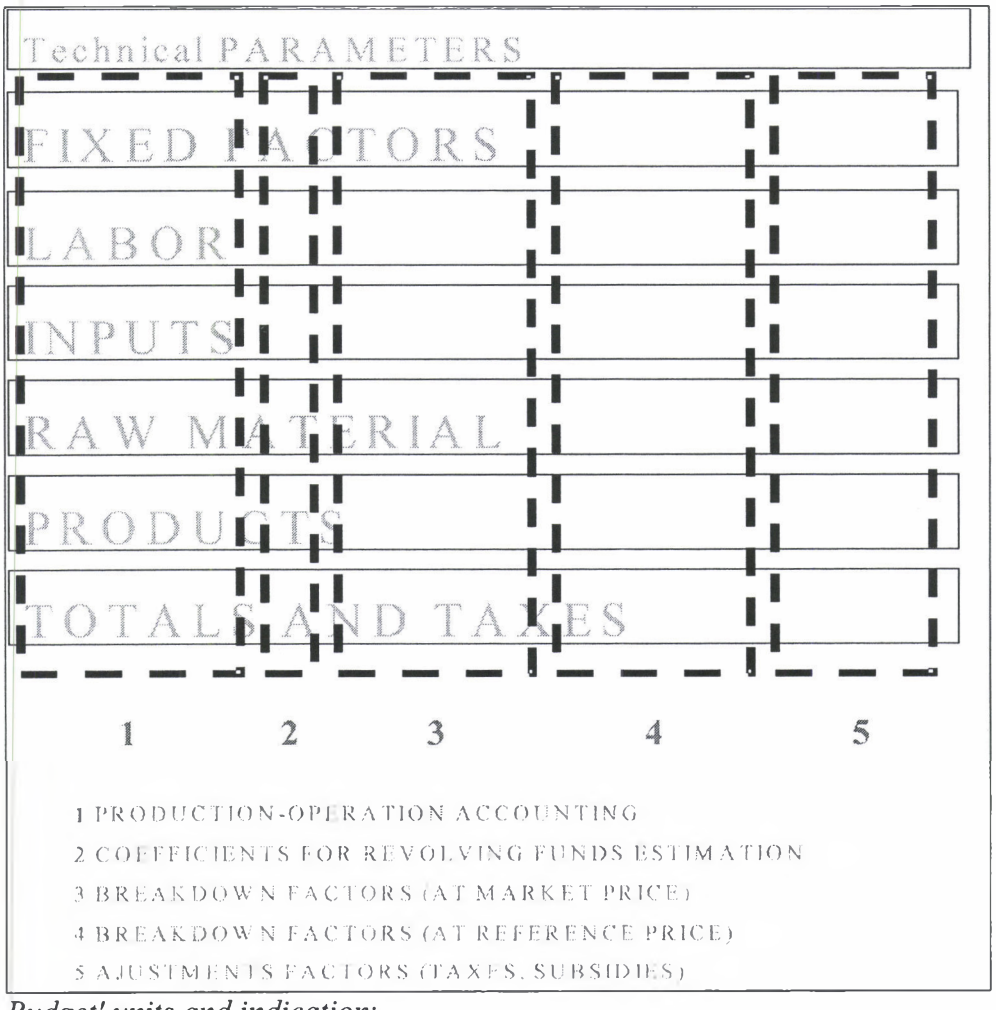
	A	B	C	D	E
9	**BUDGET #1 - FARM LEVEL**				
10					
11	FARM MAIN OUTPUT	raw cotton			
12	LENGTH OF PRODUCTION CYCLE:	8months			
13	Budget #1 computed in:	sp by Ha of raw cotton			
14		-------- TOTAL ANNUAL CAPITAL COST---------			
15		Life-	Used up	Capital Cost	
16	B1. FIXED INPUT	Time	Value	Market	Social
17			1	5.5%	3.0%
18			1	0.0%	0.0%
19	TOTAL				

1.1.1.2.Budgets

Following the format applied in the Monke and Pearson manual each Budget includes horizontally a block of data for fixed costs, labor, inputs, raw material (or commodity in process), products (or sales) l and taxes (Figure 5). Vertically each budget is divided into five areas.

- The first area on the left is used to register each cost items, quantity and unit price.
- The following one is used to indicate the time along which the money used to purchase an input is immobilized in order to compute the opportunity cost of the financial capital invested in the operation.
- The third vertical area is devoted to the computation of the budget at market price, each cost being decomposed into qualified and non qualified labor, capital and tradable input, on the basis of coefficients applied to the total value of the cost item.
- The fourth column provides the budget in social price terms, based on the market prices adjusted values. The adjustments are based on the coefficients of distortion inputted at the top of the spreadsheet (divergence for wages, exchange rate…) for the domestic factors and fixed and ad valorem duty (or subsidy) for tradable inputs. While distortions for wages and capital are uniform for all budgets, custom duty can be entered separately for each cost item.
- The fifth column is devoted to the entry of custom duties for each cost item and repeats the value entered to account for the divergence on domestic factors market and currency market.

Figure 5: Budget organization in the spread sheet.



Budget' units and indication:

At the top of the farm budget, there is a data entry area to indicate

- The form of the output produced
- Length of the production cycle
- Currency unit
- Volume unit
- Area measurement unit
- Size of the reference plot.

Figure 6 Farm budget information and units

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
9	BUDGET #1 - FARM LEVEL														
10															
11	FARM MAIN OUTPUT	raw cotton						CURRENCY:	sp				AREA MEASUREMENT UNIT:	Ha	
12	LENGTH OF PRODUCTION CYCLE:	8months						PRODUCTION UNIT:	ton				PLOT SIZE:	1	
13	Budget #1 computed in:	sp by Ha of raw cotton													

At the top of the post-harvest budgets the user should indicate.

- The form of the main output
- Length of the production cycle
- Volume unit
- Conversion rate from the raw input (or commodity in process) to the main output
- Conversion rate from the raw input (or commodity in process) to the by-product
- Conversion rate from the raw input (or commodity in process) to losses.

Remark: currency unit is entered only at the farm budget level and reported to the other Budgets.

Figure 7: Post-harvest budgets information, units and conversion rate.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
57	BUDGET #2 - POST-HARVEST ACTIVITY FARM TO PROCESSOR														
58	SYSTEM	network irrigated cotton large ginery													
59													CONVERSION RATE		
60	MAIN OUTPUT	raw cotton						CURRENCY	sp				MAIN OUTPUT		1.000
61	LENGTH OF PRODUCTION CYCLE:							PRODUCTION UNIT:	ton				BY-PRODUCT		1.000
62	Budget #2 computed in:	sp by ton of raw cotton											Losses (%)		0.0%

Fixed input data entry area:
For fixed input the user should indicate the life time of the equipment, used up value (share of the equipment used for the production of the selected output), initial cost and salvage value.

Figure 8 Fixed inputs data entry area for cost item

		-------- TOTAL ANNUAL CAPITAL COST---------					
14							
15		Life-	Used up	Capital Cost		Initial	Salvage
16	B1. FIXED INPUT	Time	Value	Market	Social	Cost	Value
17			1	5.5%	3.0%	0	0
18			1	0.0%	0.0%	0	0
19	TOTAL						

At the far right end side of the budget, the user should key in

- The ad-valorem and fixed duty applied on the importation of the fixed input.
- The salvage value of the fixed input without accounting for custom duty
- The share of non-qualified labor, qualified labor, capital and tradable in the total value of the fixed input; the share are entered as a coefficients.

Figure 9: Fixed input data entry area for duties and coefficient of decomposition into tradables and non-tradables.

	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH
	--- TI ---		Exch.		Price	Salvage	Coef.Capita	Initial disaggreg				
	ad		Rate		Before	Value	Recovery	L	L			Control
	valorem	fixed			Tax	Before Tax	rate	NQ	Q	K	TI	TOTAL
)%	0%	0	1		0	0	0.000	0.00	0.00	0.00	0.00	0.00
)%	0%	0	1		0	0	0.000			1.00		1.00
							social price	(before depreci-				

Variable inputs data entry area

For variable input the user should indicate, unit price, quantity and frequency of use (for input that are used at different time of the production cycle). The duration of the working capital immobilized for each input is entered into a specific column entitled Revolving fund as a coefficient indicating the share of the total duration of the process during which the corresponding expenditures will be immobilized before the agent can get a return to its investment. For instance land preparation will have a coefficient of 1 while harvesting will have a coefficient of 0 if the usual practice is to sell the production at harvest time.

Four columns re earmarked for keying in coefficients of decomposition of each cost item into domestic factors including non qualified labor (L-NQ) , qualified labor (L-Q) and capital (K) and tradable input (TI)

Remark: For post-farm budgets the value of the commodity in process (the output from the previous agents) is automatically computed using the appropriate conversion coefficient keyed in at the top of the budget.

Figure 10: Variable cost. Data entry areas

115	BUDGET #3 - POST-HARVEST ACTIVITY PROCESSING						Revolving				
116		----------Budget information ----------						----- Disaggregation at market price -----			
117	B3. DIRECT LABOR	Unit	Price	Quantity	Freq	TOTAL	Fund	L-NQ	L-Q	K	TI
118	permanent labour	sp/ton	145.4	1	1	145	1.00		1.00		
119	casual labour	sp/ton	780.9	1	1	781	1.00	1.00			
120			0	0	1	0	1.00		1.00		
121	TOTALS							781	145	0	0
122	BUDGET #3 - POST-HARVEST ACTIVITY PROCESSING						Revolving				
123		---------- Budget information ----------						----- Disaggregation at market price -----			
124	B3. INTERMEDIATE INPUT	Unit	Price	Quantity	Freq	TOTAL	Fund	L-NQ	L-Q	K	TI
125	packing and wrapping materials for seeds	sp/ton	140	1	1	140	0.50	0.05	0.05	0.10	0.30
126	energy and water	sp/ton	400	1	1	400	0.50	0.01	0.03	0.04	0.92
127	spare parts	sp/ton	200	1	1	200	0.50	0.05	0.05	0.10	0.80
128			0	0	1	0	1.00				1.00
129	Interest: on Revolving Fund	*at market*	5.5%	70011	0.25	963				1.00	
130		*at social*	3.0%	59448	0.25	446				0.00	
131	TOTAL		*rate*	*amount*	*year*			21	29	1013	570
132	BUDGET #3 - POST-HARVEST ACTIVITY PROCESSING										
133	B2. COMMODITY IN PROCESS	Unit	Price	Quant		TOTAL					
134	raw cotton at ginnery gate	ton	22000	3.125		68750	1.00				
135							0.00				

The right hand side of the variable costs budget is used to key in custom duties - as a positive value, or any subsidy (direct or implicit) as a negative value - to compute the value of input at social prices from their corresponding value at private prices. Two types of duty can be keyed in: ad valorem duty or fixed duty.

Figure 11: Date entry area for custom duties or subsidy on tradable input.

W	X
--- TI ---	
ad valorem	fixed
0%	0
0%	0
0%	0
0%	0
0%	0
--- TI ---	
ad valorem	fixed
1.7%	0
1.7%	0
1.7%	0
1.7%	0
-18.0%	0
0.0%	0
0.0%	0
0.0%	0
0%	0
0%	0
0%	0

Revenue and direct tax on profit.

The volume and value of the main output (yield in the case of the Farm level budget and any by-products is keyed in at the bottom of each budget. An additional line is earmarked to enter tax on profit.

Figure 12 Data entry area for revenue and direct tax.

132	BUDGET #3 - POST-HARVEST ACTIVITY PROCESSING											TOTAL
133	B2. COMMODITY IN PROCESS	Unit	Price	Quant	TOTAL							Market
134	raw cotton at ginnery gate	ton	22000	3.125	68750	1.00						68750
135						0.00						
136	TOTAL											68750
137	BUDGET #3 - POST-HARVEST ACTIVITY PROCESSING											TOTAL
138	B3. REVENUES	Unit	Price	Quant	TOTAL							Market
139	lint cotton	ton	60000	1	60000							60000
140	seed	ton	6000	1.96875	11813							11813
141	waste1	ton	10000	0.1	1080							1080
142			0	0	0							0
143	TOTAL REVENUES											72893
144	TOTAL COST						819	183	1184	658		71594
145	PROFIT (BEFORE TAXES)											1298

Subsidy or taxes levying on output are inputted in the Budget summary table (Figure 13).

1.2.2. Results presentation

1.1.1.3.Summary budget

The first types of outputs provided by the PAM spreadsheet are the two summary budgets, one on volume basis and one on hectare basis. Budget summary tables are divided in there blocks, one on the left hand side indicating the values at private price, the central one for the budget value at social price and the right hand side indicating the divergence. Each block contains columns summarizing the value for the Farm level budget and the other post-farm budgets, aggregated value for the post farm operations and the last column of each block giving the aggregated value for the whole system.

The aggregated budget items are:

- Total Revenues, broke down into:
  - Main Final Output
  - By-Products
- Total Cost, broke down into:
  - Commodity In Process
  - Tradables
  - Domestic Factors
    - Unskilled Labor
    - Skilled Labor
    - Capital
- Profit Before-Taxes:
  - Direct Taxes:
- Profit After-Taxes:

Figure 13 Budget summary tables.

196	TABLE 1. BUDGET SUMMARY	network irrigated cotton large ginery																	
197							July 2004												
198		UNIT Thousands sp by Ha																	
199																			
200			----VALUES AT MARKET PRICE----						---- VALUE SOCIAL PRICE ----						---DIVERGENCES---					
201			Budget	Budget	Budget	POST	Repre.		Budget	Budget	Budget	POST	Repre.		Budget	Budget	Budget	POST	Repre.
202		FARM	#2	#3	#4	FARM	System	FARM	#2	#3	#4	FARM	System	FERME	#2	#3	#4	FARM	System
203	1.TOTAL REVENUES	84	84	89	74	90	90	71	71	73	58	74	74	13	13	15	16	16	16
204	Main final ouput	84	84	73	74	74	74	71	71	58	58	58	58	13	13	15	16	16	16
205	By-products	0	0	16	0	16	16	0	0	16	0	16	16	0	0	0	0	0	0
206	2. TOTAL COST	74	84	87	73	88	78	113	71	73	58	74	116	-39	13	14	15	14	-38
207	A. Commodity in process		84	84	73	84			71	71	58	71			13	13	15	13	0
208	(tax+,subsidy-)	0	0	0	0	0	0												
209	B. Tradables	21	0	1	0	1	22	26	0	1	0	1	28	-5	0	0	0	0	-5
210	C. Domestic Factors	53	0	3	0	3	55	86	0	2	0	2	88	-34	0	1	0	1	-33
211	Unskilled Labor	32	0	1	0	1	33	33	0	1	0	1	34	-1	0	0	0	0	-1
212	Skilled Labor	2	0	0	0	0	2	2	0	0	0	0	2	0	0	0	0	0	0
213	Capital	19	0	1	0	1	20	52	0	1	0	1	52	-33	0	1	0	1	-32
214	PROFIT BEFORE-TAXES:	10	0	2	1	2	12	-42	0	0	0	0	-42	52	0	2	1	2	54
215	Direct taxes:	0	0	0	0	0	0												
216	PROFIT AFTER-TAXES:	10	0	2	1	2	12							(+tax,-= subsidy)					
217																			
218		UNIT sp by ton of lint cotton																	
219																			
220			----VALUES AT MARKET PRICE----						---- VALUE SOCIAL PRICE ----						---DIVERGENCES---					
221			Budget	Budget	Budget	POST	Repre.		Budget	Budget	Budget	POST	Repre.		Budget	Budget	Budget	POST	Repre.
222		FARM	#2	#3	#4	FARM	System	FARM	#2	#3	#4	FARM	System	FERME	#2	#3	#4	FARM	System
223	1.TOTAL REVENUES	68750	68750	72993	61000	73993	73993	58209	58209	60426	48000	60893	60893	10541	10541	12466	13000	13000	13000
224	Main final ouput	68750	68750	60000	61000	61000	61000	58209	58209	47534	48000	48000	48000	10541	10541	12466	13000	13000	13000
225	By-products	0	0	12893	0	12893	12893	0	0	12893	0	12893	12893	0	0	0	0	0	0
226	2. TOTAL COST	60506	68750	71594	60400	71994	63750	92679	58209	60426	48000	60891	95360	-32173	10541	11168	12400	11104	-31610
227	A. Commodity in process		68750	68750	60000	68750			58209	58209	47534	58209			10541	10541	12466	10541	0
228	(tax+,subsidy-)	0	0	0	0	0	0												
229	B. Tradables	17288	0	658	320	978	18266	21682	0	678	390	1068	22750	-4394	0	-20	-70	-90	-4484
230	C. Domestic Factors	43217	0	2197	80	2267	45484	70996	0	1538	76	1614	72610	-27779	0	649	4	653	-27126
231	Unskilled Labor	26203	0	819	20	839	27042	27216	0	816	20	836	28052	-1013	0	3	0	3	-1010
232	Skilled Labor	1461	0	183	20	203	1664	1344	0	145	16	161	1505	117	0	38	4	43	159
233	Capital	15554	0	1184	40	1224	16778	42436	0	577	40	617	43053	-26882	0	607	0	607	-26275
234	PROFIT BEFORE-TAXES:	8244	0	1298	600	1898	10143	-34469	0	0	0	0	-34468	42714	0	1298	600	1898	44610
235	Dircet taxes:	0	0	0	0	0	0												
236	PROFIT AFTER-TAXES:	8244	0	1298	600	1898	10143							(positive=tax, negative=subsidy)					

1.1.1.4.PAM

The second type of output is the two PAMs computed on a volume basis and on a per hectare basis.

Figure 14 PAM tables

	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU
193											
194											
195											
196		**TABLE 3A: POLICY ANALYSIS MATRIX**									
197											
198		network irrigated cotton large ginery							Version	July 2004	
199		UNIT: sp par Ha									
200											
201					COSTS						
202			REVENUES		TRADABLES INPUTS		DOMESTIC FACTORS		PROFITS		
203											
204			A		B		C		D		
205		PRIVATE PRICES		89 853		22 212		55 308		12 333	
206											
207			E		F	G	G		H		
208		SOCIAL PRICES		74 045		27 664		88 294		-41 913	
209											
210			I		J		K		L		
211		DIVERGENCES		15 808		-5 452		-32 986		54 246	
212											
213											
214		**TABLE 3A: POLICY ANALYSIS MATRIX**									
215											
216		network irrigated cotton large ginery									
217		UNIT: sp by ton of lint cotton							Version	July 2004	
218											
219					COSTS						
220			REVENUES		TRADABLES INPUTS		DOMESTIC FACTORS		PROFITS		
221											
222			A		B		C		D		
223		PRIVATE PRICES		73 893		18 266		45 484		10 143	
224											
225			E		F		G		H		
226		SOCIAL PRICES		60 893		22 750		72 610		-34 468	
227											
228			I		J		K		L		
229		DIVERGENCES		13 000		-4 484		-27 126		44 610	
230											
231											
232											

1.1.1.5.Indicators

The third type of outputs provided by the spreadsheet is an array of indicators. The formula used for the computation of each indicator is recall in a specific column.

Beyond the usual list of indicators derived from the PAM as proposed by Monke and Pearson, the table also includes the computation of the Nominal Protection Coefficients without taking into account the value of the by-product at the processing stage. As a matter of fact, if the by-product represents a large share of the total revenue of the system the impact of any policy affecting the value of the main output would not be adequately represented by an indicator that do not distinguish between the main output and the other ones.

The table of indicator also computes the Social Benefit Cost ratio, another indicator of the comparative advantage less sensitive to the share of tradable in the cost structure. It is recommended to use this indicator when the analyst want to rank the respective positions in terms of comparative advantage of commodity chains that have different cost structures[3].

[3] Masters W.A and Winter-Nelson A, *Measuring the Comparative Advantage of Agricultural Activities: Domestic Resources Costs and the Social Cost-Benefit Ratio*, American Journal of Agricultural Economic, 77, may 1995, pp 243-250.

Figure 15 The table of indicators

	BC	BD	BE BF	BG	BH	BI	BJ
193							
194							
195							
196		**TABLE 2A: POLICY ANALYSIS INDICATORS**					
197							
198		1. FINANCIAL PROFITABILITY			[D = A - B - C]		10 143
199							
200		2. FINANCIAL COST-BENEFIT RATIO			[C / (A - B)]		0.818
201							
202		3. SOCIAL PROFITABILITY			[H = E - F - G]		-34 468
203							
204		4. DOMESTIC RESOURCE COST			[G / (E - F)]		1.904
205							
206		5. SOCIAL COST-BENEFIT RATIO			[(F + G) / E]		1.566
207							
208		6. TRANSFERS			[L = I + J + K]		44 610
209							
210		7. NOMINAL PROTECTION COEFFICIENT			[A / E]		1.213
211		(Including by-product)					
212		7A. NOMINAL PROTECTION COEFFICIENT			[A* / E*]		1.271
213		(Main final output only)					
214		8. EFFECTIVE PROTECTION COEFFICIENT			[(A - B) / (E - F)]		1.458
215							
216		9. PROFITABILITY COEFFICIENT			[D / H]		-0.294
217							
218		10. PRODUCERS SUBSIDY RATIO			[L / E]		0.733
219							
220		11. EQUIV. PRODUCER SUBSIDY			[L / A]		0.604
221							

1.1.1.6. Break even point.

The last outputs provided by the PAM spreadsheet are breakeven points for an array of cost variables and technical coefficients (Figure 16). On the bases of the ratio of the profit value to 0, as reported in the Budget summary, the spreadsheet provide the yield level, the value of post-harvest cost and the value of domestic factors cost for which the representative system will break even at market price and at social price.

Figure 16 Breakeven points table

	BC	BD	BE BF	BG	BH	BI
223						
224		**TABLE 2B: BREAK EVEN POINT**				
225						
226				At Market		At Social
227				price		price
228					*(% of current value)*	
229						
230		Yield:		3.34		6.05
231				*0.88*		*1.59*
232						
233		FINAL OUTPUT PRICE:		50857.48		82467.6
234				0.83		*1.72*
235						
236		POST HARVEST COSTS		11488.87		-31786.07
237				*3.54*		*-11.85*
238						
239		DOMESTIC FACTORS COSTS		55626.13		38142.40
240				*1.22*		*0.53*
241						

2. Computation rationale

2.1. Computation sequence at the budget level.

2.1.1. PAM Budget computation at market price.

Fixed cost. The first block at the top of each Budget is devoted to the computation of the fixed cost. Following the method advocated by the Monke and Pearson, the depreciation of the capital invested is based on the Capital recovery rate (Crr) method (cf. Appendix B for additional details). Expected life time, initial value, salvage value and the shared of the equipment or investment used for the production of the main final output are inputted as basic information. The Crr is computed at private and social price with the corresponding interest rate.

Figure 17 provides a simplified presentation of the fixed costs computation procedures on the spreadsheet (without distinction between qualified and non-qualified labor). The depreciated value at market price of the fixed cost is computed by multiplying the Crr and the initial value of the investment. For each fixed cost item the respective share of tradable and non tradable value is provided in the foremost right area of the fixed cost bloc (cf. Figure 9, p 9). The computation of the share of labor, capital and tradable content of the fixed cost is based on budgets established from primary or secondary data source or educated guess estimates if no data are available. The procedure followed to compute these coefficients are presented in section 2.2.1, page 28. The rationale behind the formula used to compute the coefficient of decomposition at market and social prices is presented in detailed in Appendix B. The total value of labor, capital and tradable input at market price is computed by adding the depreciated values of each cost item weighted by each corresponding coefficients.

Direct labor cost. The second budget block records labor directly used/paid by the agent in the production process. By definition, the corresponding coefficients of decomposition for capital and tradable input are null, while the direct labor cost can be allocated either to qualified or non-qualified labor (Figure 18).

Intermediate input cost. All other inputs are recorded in the third bloc. In this case the value of each input can be decomposed into domestic factors and tradable input components. For instance, even the value of imported fertilizer purchase will bear a share of labor and capital corresponding to the importing, transportation and retailing operations within the national economy (Figure 18). Section 2.2.1, on page 28, present a method to compute these coefficients.

Interest on revolving funds. While the opportunity cost of the financial capital invested in fixed cost is taken into account by the Crr, for variable costs, the corresponding values are computed on the bases on (i) the total duration of the production process and take into account (ii) the period between the actual time of each expenditure and the end of the production when the agent can earn its return on the investment by selling the product (Figure 19). The spreadsheet computes the total opportunity cost of the funds invested by (i) adding the total value of the variable costs weighted by these coefficients and then multiplying this amount with the selected annual interest rate weighted by the ratio of the total duration of the process to one year.

Figure 17: Fixed costs computation at market price

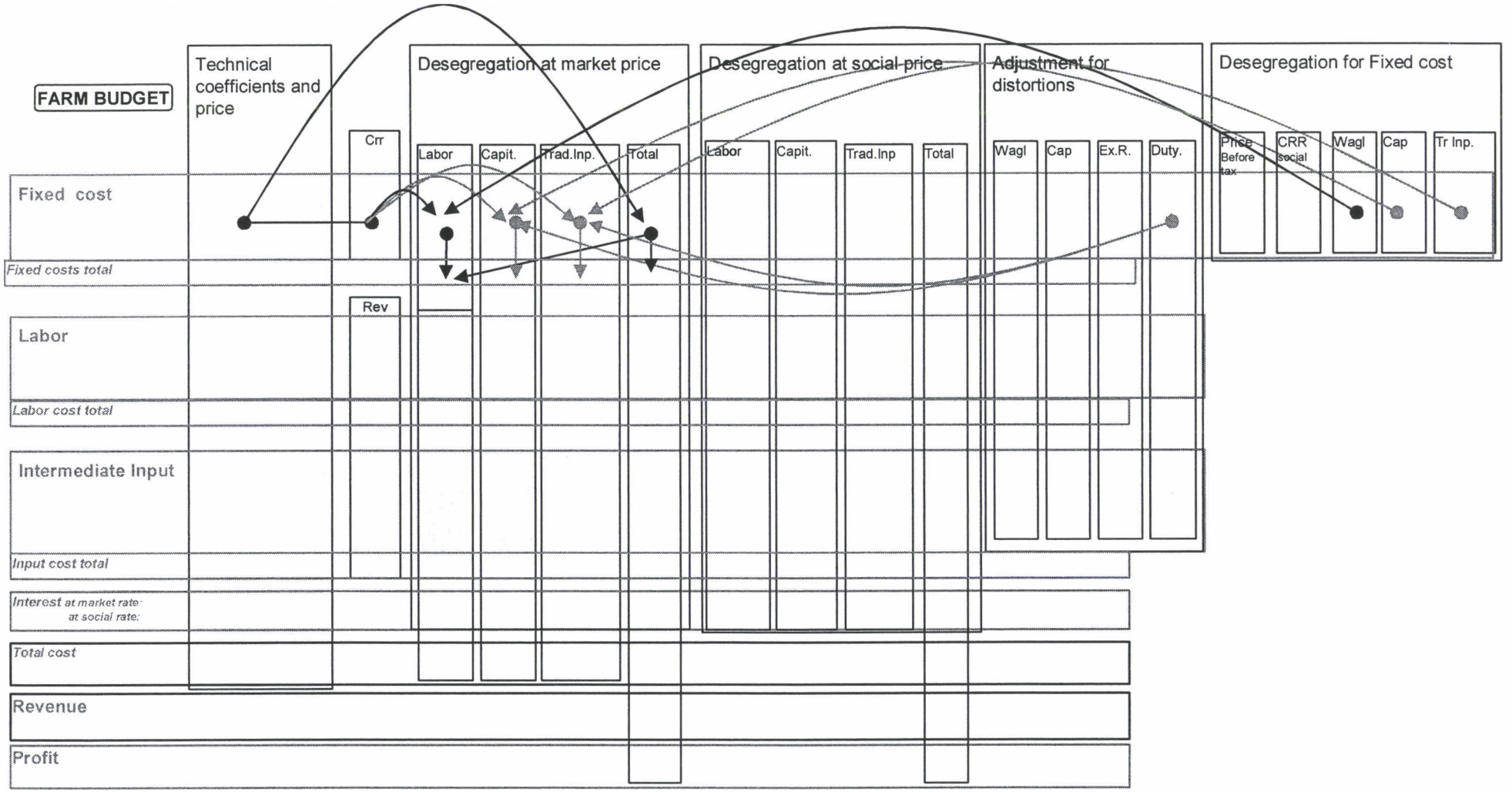


Figure 18: Variable costs computation at market price

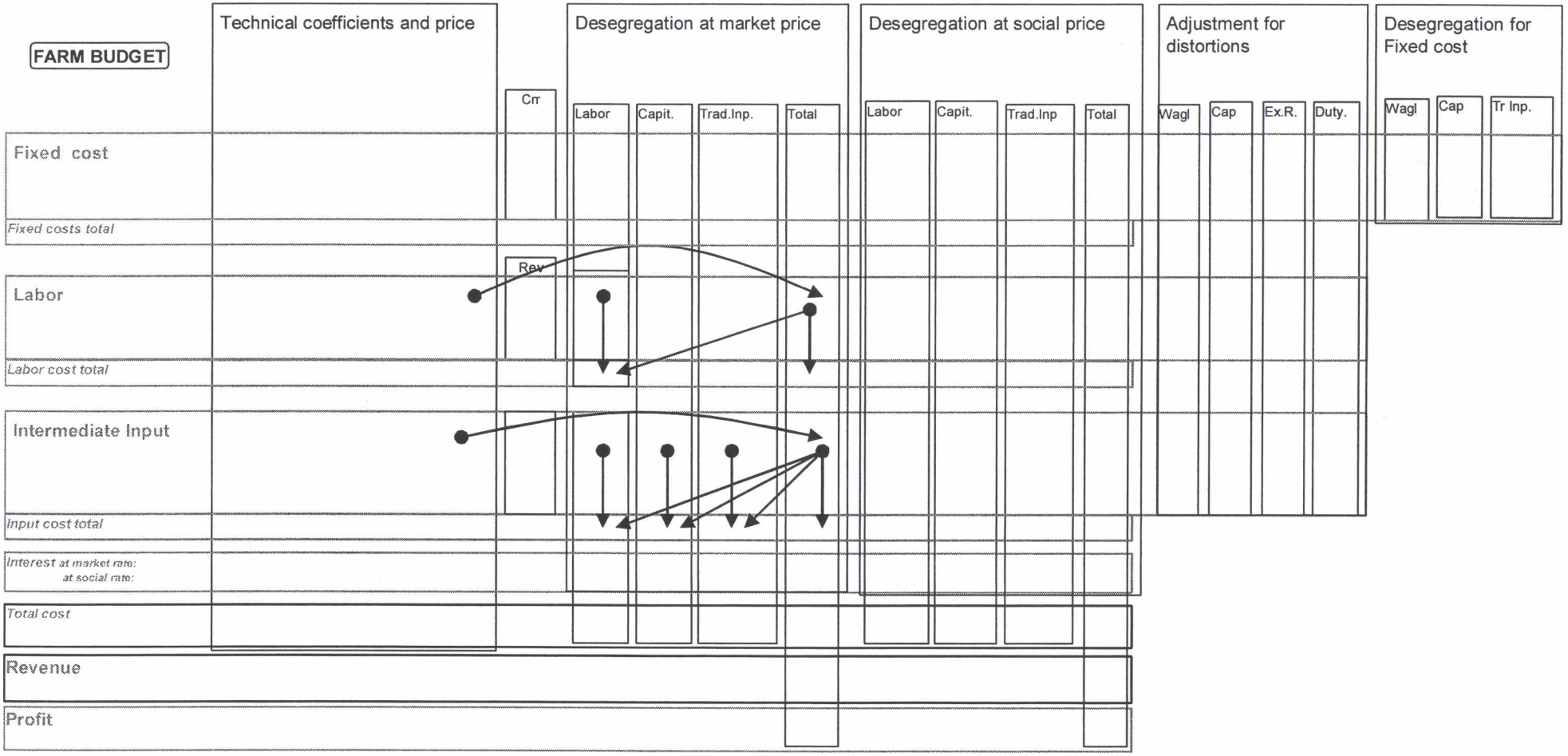


Figure 19: Computation of interest on revolving funds

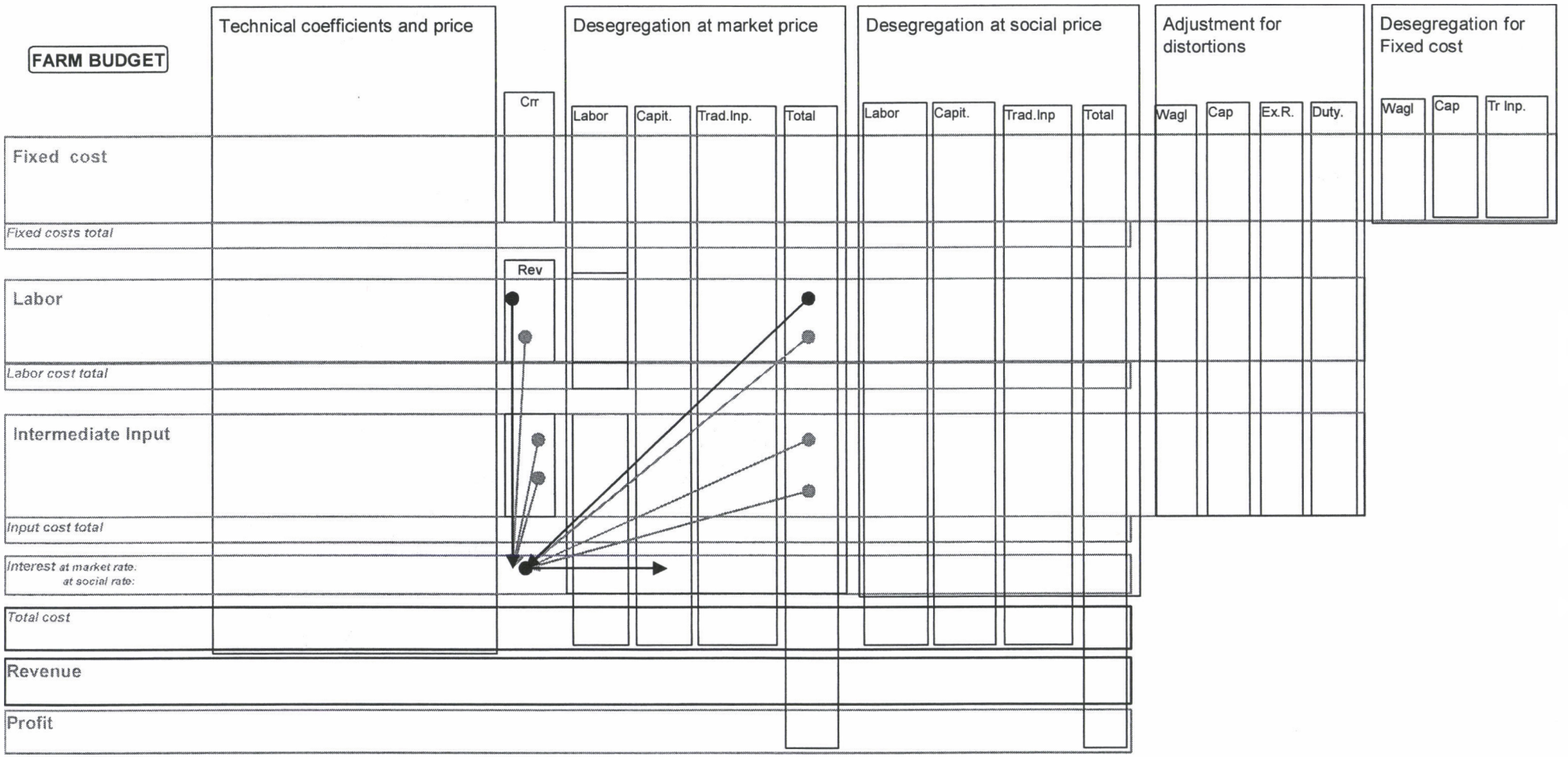
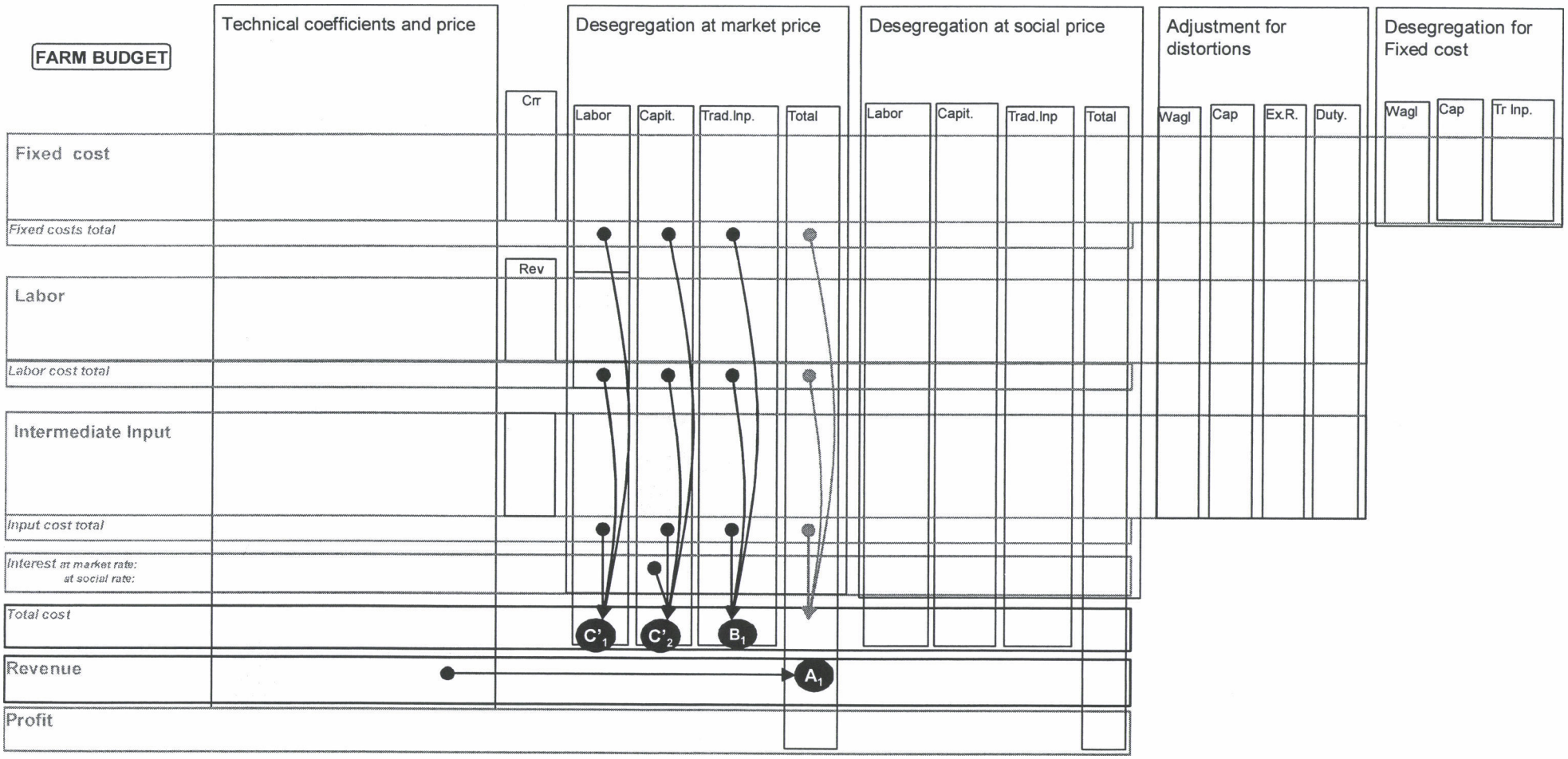


Figure 20: PAM market prices value computation



Eventually the corresponding value is inputted as a capital cost at the bottom of the third block (detailed explanation on the rationale of the computation is given in Appendix B).

If the representative system include only one budget, the first row of the PAM is given by the simple addition of the share of the costs attributed to labor, capital and tradable input. In the case of the farm budget the revenue is straightforwardly given by the production and the unit price. Figure 20 indicates the flows of computation leading to the corresponding PAM accounting entities.

2.1.2. PAM Budget computation at social price:

The sequence of computation at social price (Figure 21, Figure 22, Figure 23,) follows a pattern similar to the sequence followed at private price. The adjustment from private to social prices are computed by modifying the coefficients applied to decompose cost items value into domestic factors and tradable inputs.

As already indicated above, adjustments for the value of the decomposition coefficient from market to social price changes are based on distortion parameters that are unique for the whole spreadsheet. For instance, if qualified labor incurred a given percentage of transfer, the decomposition coefficient for skilled labor at market price of each cost items will be adjusted on the bases of the same parameter that are repeated at each line of the budget on the fourth right hand column. Of course all the computation involving the interest rate (Crr, revolving funds…) will be carried out with the social interest rate.

For tradable input purchase the adjustment is done, cost item by cost item, on the bases of the custom duties pertaining to each type of intermediate goods. Once the appropriate custom duties is inputted in the fourth group of columns, the spreadsheet compute the corresponding parity price by adjusting the tradable input coefficient and taking into account any distortion for the exchange rate. If the input benefit from a direct or implicit subsidy, the corresponding value of the subsidy should be inputted in the "Duty" as a negative figure.

For a system with only one system, the second row of the PAM will be obtained by adding all labor, capital and tradable input value at social price from the three budget blocs. The parity price of the output, to compute the level of revenue, is computed on a separate spreadsheet and inputted at the bottom of the budget. Figure 24 indicates the flows of computation corresponding to the PAM accounting entities.

Figure 21: Computation of fixed costs at social price

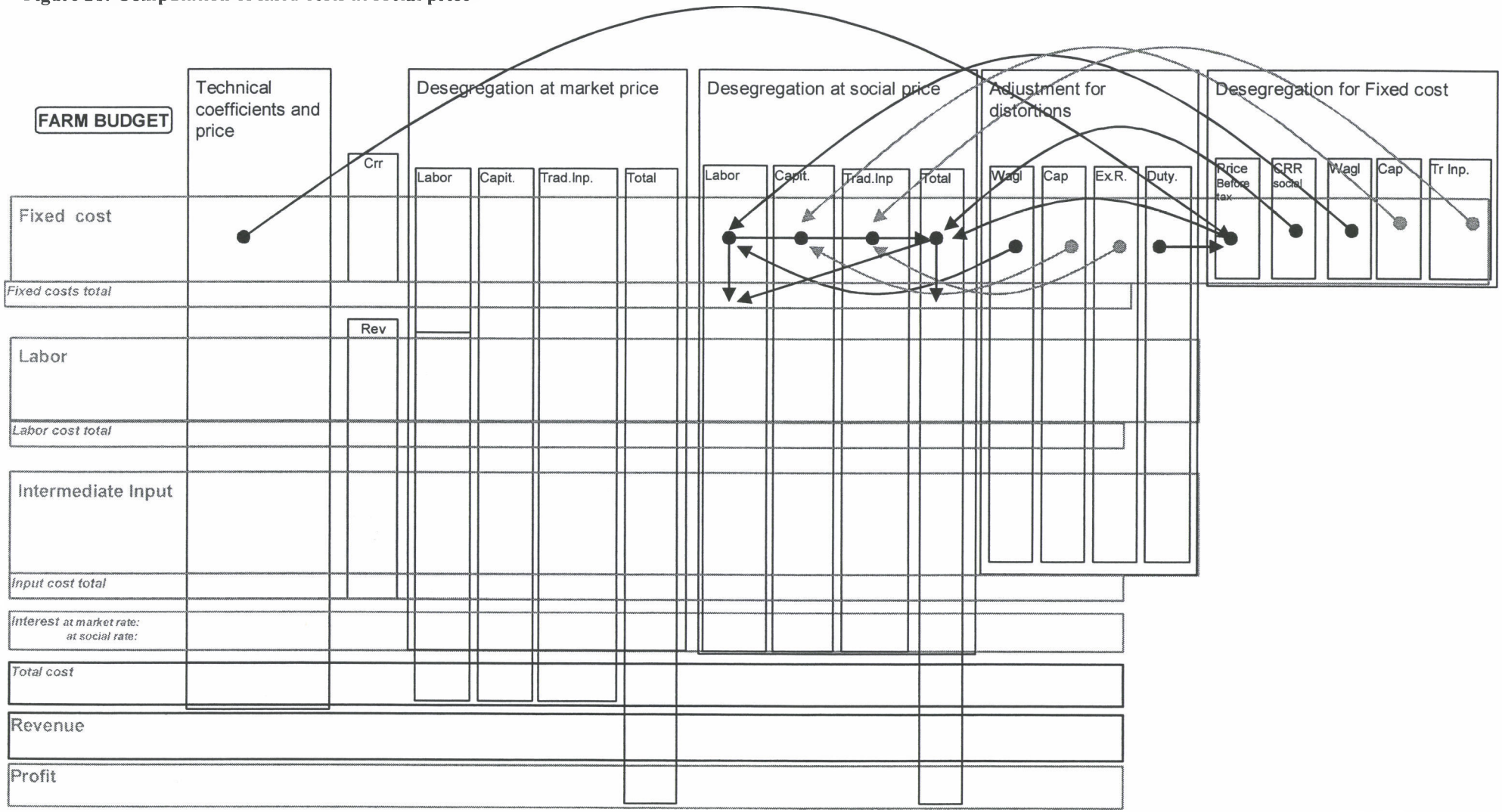


Figure 22: Variable costs computations at social price

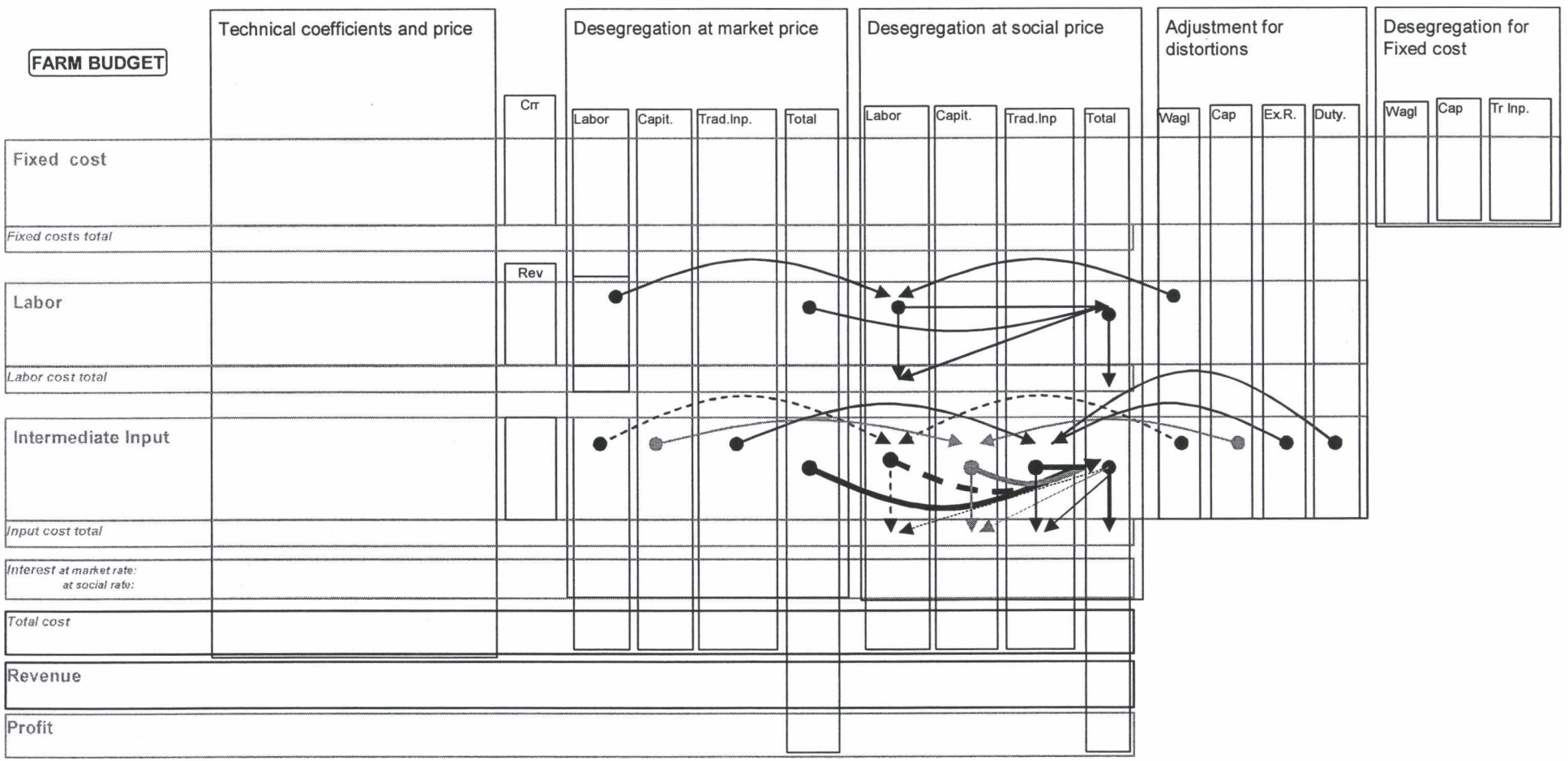


Figure 23: Computation of interest on revolving funds at social price

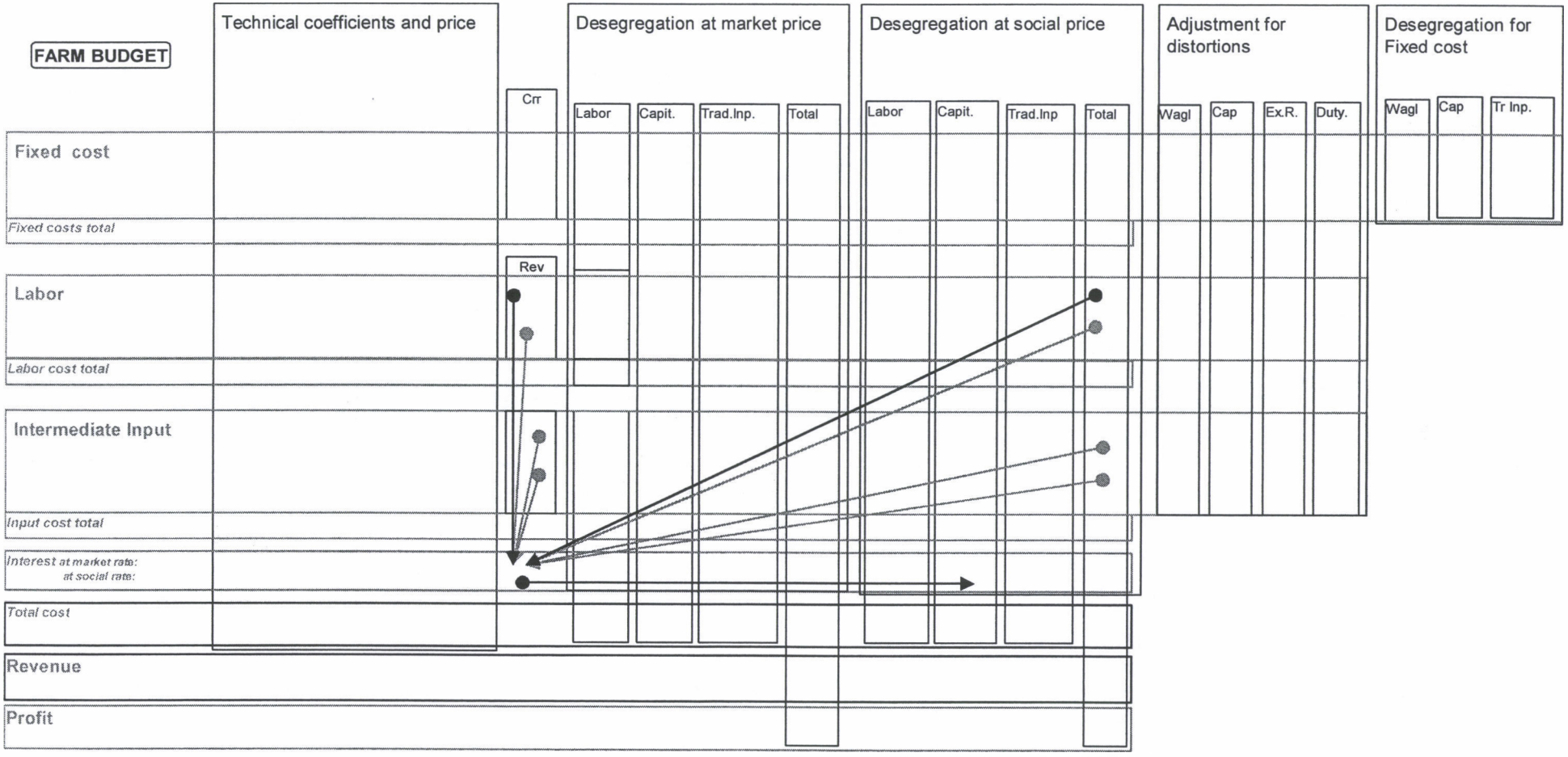
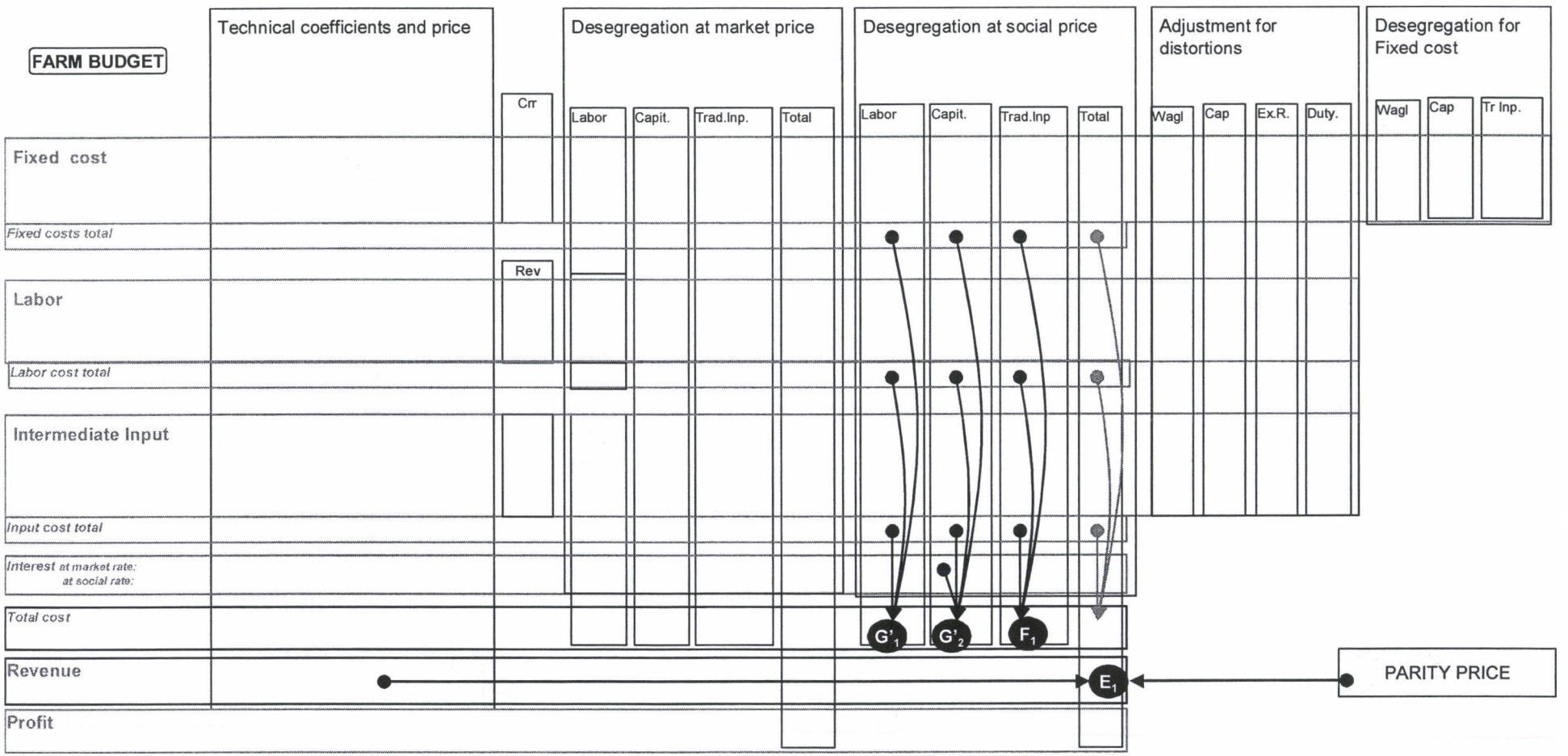


Figure 24: PAM social prices value computation



2.1.3. Computation sequence at the representative system level.

The spreadsheet allows handling four budgets, the first one corresponding to the farm level, while the next three one are used for post harvest operations. Figure 25 presents how the different types of budgets are combined to compute the PAM at the representative system level. For the sake of simplicity, the figure includes only one Farm level budget and two post-farm budgets.

Starting on the left hand side of the spreadsheet, at market price, the production of the first budget becomes a particular intermediate input for the following operation: the commodity in process. This transfer from one agent to another takes into consideration the conversion rate in order to get the final aggregated results in terms of unit of final main output. For instance in a system with two agents including a wheat producer and a miller, the PAM will be established in term of flour output at the mill level. The conversion rate of, 0.8 or 80%, inputted at the top of the miller's budget indicate that you can get 800 kg of flour from 1000 kg of wheat, which imply that the miller need to purchase 1250 kg of wheat to get 1000 kg of wheat flour. This amount is automatically put into the Commodity in Process row in the miller budget.

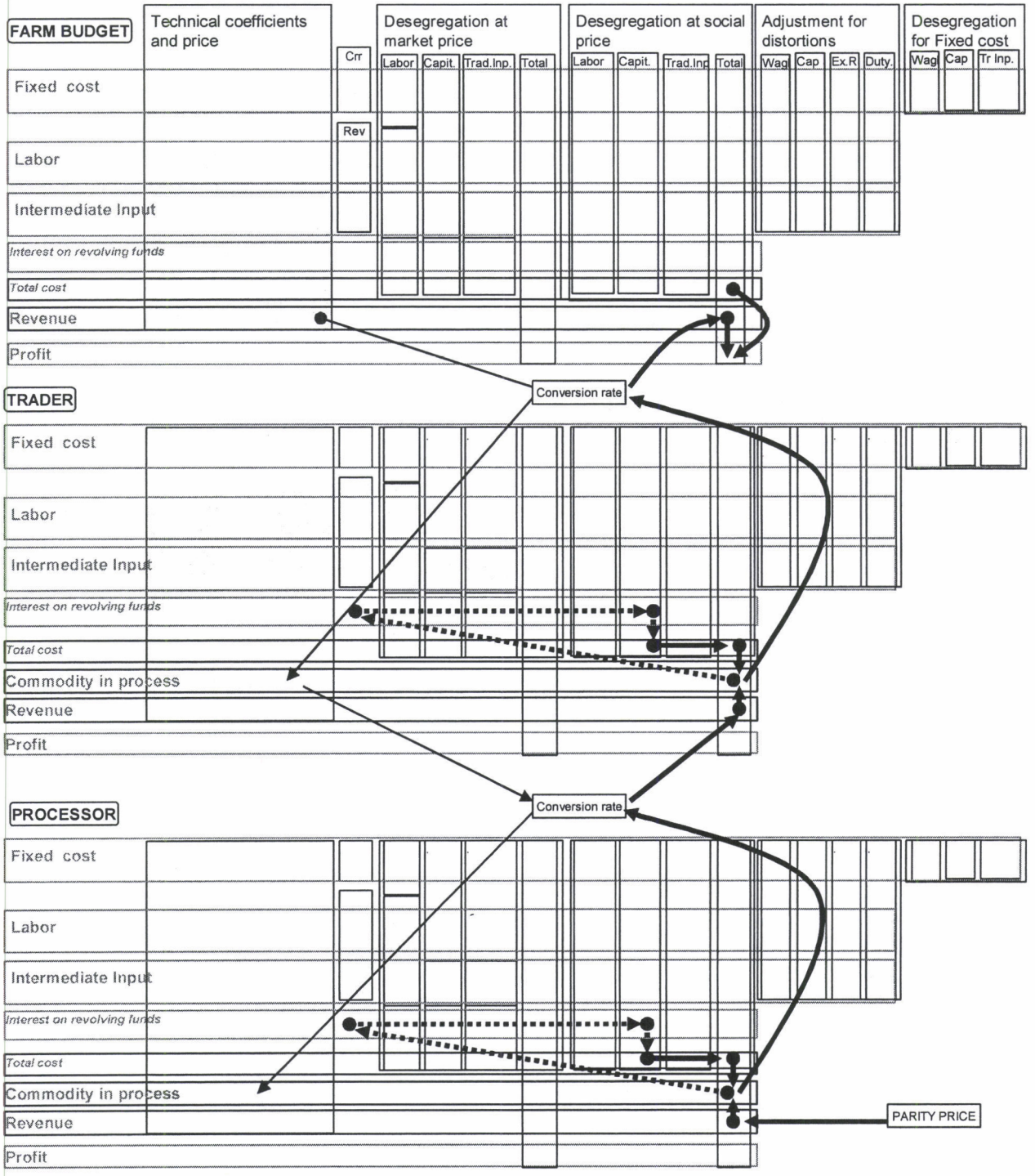
At market price, the value of the PAM at the system level is obtained by adding all the tradable and non-tradable computed for each budget, without, taking into account the value of the commodity in process, but taking into account the opportunity cost of the funds used to purchase it from the previous agents. The total revenue of the system is given by the revenue of the last agent of the system.

At social price, the computation of the second row of the PAM starts with the parity price for the main final output at the bottom of the last Budget. This parity price provides the level of revenue for a unit of main final output. By convention, the profit of the last agent at social price is null, therefore by deducting all the fixed, labor and intermediate inputs costs, which are computed independently the spreadsheet provides the value of the commodity in process at social price for the last budget of the system. In a commodity chain, by definition, the value of the commodity in process purchased by a given agent corresponds to the revenue of the up-stream agent supplying the commodity in process, taking into account the adjustment related to the processing (conversion rate, losses). Using the same convention of social profit equal zero for this previous or immediate up-stream agent (the trader budget in Figure 25), the value of the commodity in process for this previous agents can be obtained by deduction of the total costs at social price.

This procedure allows computing the value at social price of the revenue earned by the first agent of the representative system, i.e. the farmer. The first agent is not purchasing any "commodity in process", it is, therefore, possible to compute the value of his profit at social price by deducting from its revenue the total value of costs at social price. In fact, the profit at social price computed in the first budget is profit for the whole representative system.

The dotted line indicates that the value of the opportunity cost of the commodity in process is obtained by applying the social interest rate to the social value of the commodity in process. The result is then included in the social cost, which reduced by a similar amount the value of the commodity in process. This circular computation is solved by an iterative process (cf. p 32).

Figure 25 : Computation sequence at the representative system level



2.2. Complementary computations

This section presents complementary computations and possible adjustments that have to be made to feed the required information into the PAM spreadsheet

2.2.1. Computation of the decomposition coefficients.

Two types of decomposition coefficients have to be inputted in the PAM spreadsheet, one for the decomposition of the fixed input, the other one for the decomposition of the intermediate inputs. In principle, these coefficients can de deducted from Input/Output tables produced for National Accounting, but they are rarely available and detailed enough to do so. It is, therefore, necessary to rely on primary or other secondary sources of information to establish a typical budget of the cost involved in the production of the input used in the PAM budget. Accordingly two spreadsheet formats have been developed to assist the user in computing the coefficients (<Format for decomposition of coefficient.xls>).

Decomposition of fixed costs into tradable and non-tradable components. The first format (Figure 26) computes the share of tradable and non tradable before inputting custom duties. The different costs are listed on the left hand side of the table and are reported in the four columns on the right hand side of the table according to their category: labor, capital and tradable. For tradables, the values of ad valorem and fixed duties are deducted. Then, each category is summed up at the bottom of the table, and the corresponding coefficients are computed (display in red). These coefficients are keyed in the right hand side of the fixed cost budget block of the PAM spreadsheet (cf. Figure 9).

Decomposition of intermediate inputs into tradable and non-tradable components. The second format computes the coefficients for decomposing the intermediates inputs value into their tradable and non-tradable component (Figure 27). The format combines two tables, one for the fixed costs and the second one for the variable costs related to the production of the intermediate inputs. The rationale of the computation follows the one of the PAM spreadsheet.

The fixed cost block compute the annual value for fixed cost split into its tradable cost component and financial costs components (see Appendix B for complementary details). The values are reported at the top of the second table and directly allocated to the capital cost and tradable input components.

The bottom part of the second table is used to key in the variable cost. The value of the variable cost inputted should be consistent with the quantity of output indicated in the fixed cost table at the top of the format; for instance if the capacity keyed in the fixed cost table result in a used up value of 60% of the equipment annual capacity, the values keyed in for the variable cost should correspond to the same quantity.

For each variable cost, the user will indicate to which category of tradable and non-tradables the cost item belong by inputting the corresponding coefficient on the left hand side block (Heading: Coefficient). The format allows handling intermediates inputs combining tradables and non-tradables (like maintenance cost) which correspond to a second level of inputs decomposition into tradables and non tradables. The values of the tradables and non-tradables contents are then directly computed on the right hand side of the table (Heading: Values) for each cost item.

Figure 26 Decomposition of fixed costs into tradable and non-tradable content.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	**Format for Fixed costs decomposition coefficients**													
2	**Type of fixed input**	Well												
3														
4	**Cost items**	**Unit**	**Unit price**	**Quantity**	**Total cost**	**TI or non TI**	**Ad valorem duty**	**Fixed custom duty**	**Duty free value**	**Labor non-qualified**	**Labor qualified**	**Capital**	**Tradable input**	Check
5	Drilling in soil of medium hardness	lm	500	60	30 000	non TI			30 000	30 000				0
6	Provision and instalation of sleeves	lm	400	60	24 000	TI	0.4	1000	16 143				16 143	0
7	Provision and installation of pipe of 8 mm and diametre <18	lm	1 940	50	97 000	TI	0.4		69 286				69 286	0
8	Geophysical measurements	lm	600	50	30 000	non TI			30 000			30 000		0
9	Testing of well (primary cleaning)	u	10 000	1	10 000	non TI			10 000			10 000		0
10	Testing of well (72 h)	u	80 000	1	80 000	non TI			80 000			80 000		0
11	Total				271 000				235 429	30 000	0	120 000	85 429	0
12	**Decomopsoition coefficients**									**0.13**	**0.00**	**0.51**	**0.36**	1
13														

Figure 27Decomposition of variable costs into tradable and non-tradable content.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	**Format for Intermediate inputs decomposition coefficients**													
2	**Interest rate**	0.08												
3														
4	**Equipment depreciation**													
5	Item	Equipment value	Annual capacity	Capacity needed for activity	Unit of capacity	Life time (year)	Used up portion	Residual value	Ad valorem duty	Fixed duty	Financial cost and import tax	Depreciation		
6							100%				0	0		
7	Tractor	450 000	856	856	hour	15	100%	100 000	1.70%		13 493	27 397		
8							100%				0	0		
9							100%				0	0		
10							100%				0	0		
11							100%				0	0		
12	**Total**										**13 493**	**27 397**		
13														
14	**Decomposition coefficients**													
15		Value at market price	Coefficients				Values				Coefficient check	Duty on tradable	Share of TI	Wheighted Duty
16			L NQ	L Q	K	TI	L NQ	L Q	KI	TI				
17	**Fixed cost**													
18	Equipment cost TI depreciation	27 397				1	0	0	0	27 397	1	1.70%	39%	1%
19	Equipment Financial cost	13 493			1		0	0	13 493	0	1			
20	**Variable cost**													
21							0	0	0	0	0		0%	0%
22	Driver	49 933	1				49 933	0	0	0	1		0%	0%
23	Maintenance labor	6 000		1			0	6 000	0	0	1		0%	0%
24	Spare parts	12 000	0.05	0.05	0.1	0.8	600	600	1 200	9 600	1	2%	14%	0%
25	Fuel	41944	0.05	0.05	0.1	0.8	2 097	2 097	4 194	33 555	1	-41%	48%	-19%
26							0	0	0	0	0		0%	0%
27							0	0	0	0	0		0%	0%
28	**Total**	150 767	**0.35**	**0.06**	**0.13**	**0.47**	52 630	8 697	18 888	70 552	1			**-19%**
29			Decomposition coefficient											

Each category of cost component is then summed up at the bottom of the table and the coefficients are computed at the bottom at the coefficient block.

The left hand side of the table is used to enter the duty applied to each type of tradable cost (negative value in case of direct or implicit subsidy) in order to compute a weighted custom duty to be inputted in the PAM spreadsheet for the corresponding intermediate input (cf. Figure 11).

2.2.2. Computation of the main output parity price

The second spreadsheet included in the PAM model.xls file is the Parity price spreadsheet used to compute the parity price for the main output (Figure 28). The principle is to build on the left column the value of main output at market price, adding the different components from the FOB value to the CIF and the custom duties and handling costs. Then the parity price of the main output is computed without including duties and using the Social Exchange Rate. The Parity price spreadsheet has two links to the PAM spreadsheet:

- The social exchange rate to compute the parity price (Cell E14 in Figure 28) is computed by applying the coefficient of divergence inputted at the top of the PAM spreadsheet to the market price exchange rate keyed in the left hand column of the table (Cell D14).
- The PAM spreadsheet cell for keying in the parity price value (at the bottom left of budget 4 - Cell S218) is linked to the parity price obtained in the Parity price spreadsheet at Cell E33.

Figure 28 Spreadsheet for computing the parity price of the main output

	A	B	C	D	E
1	**Computation of parity price**				
2					
3	Product				
4	Quality				
5	Parity point				
6					
7		Unit	Source of infor	Value at Market Price	Value at Social price
8	**FOB to CIF**				
9	CIF price at importing country		Data		0.00
10	Quality conversion rate				
11	Insurance cost				0
12	Transport cost		Data		0
13	FOB Price	USD	Data or comp		0
14	Exchange rate		Data		0
15					
16	**FOB price in domestic currency unit**		Computed	0	0
17	**Duties**				
18	**Variable duties**				
19	....				
20	....				
21	**Fixed duties**				
22	....				
23	....				
24					
25	Total duties			0.00	
26	**Price after/before custom**		Computed	0.00	0
27	Handling cost				0
28	Transport cost				0
29	Other costs				0
30	....				0
31	....				0
32	Total cost from border to parity point			0	0
33	**Parity price at parity point**			0	0

Social exchange rate is computed on the basis of the coefficient of distortion for the currency market inputted at the top of the PAM spreadsheet (Figure 3)

The cell for inputting the parity price value at the bottom of the last budget in the PAM spreadsheet is linked to this cell

This format has to be adjusted by the user to fit to the different elements and type of duties that are applied to the main final output import or export. While it is not recommended to add too many spreadsheets to <PAM model.xls> file to limit the size and volume of computation, it is important to have this additional spreadsheet for parity price to facilitate sensitivity analysis.

3. Using the spreadsheet.

3.1. Basic principle

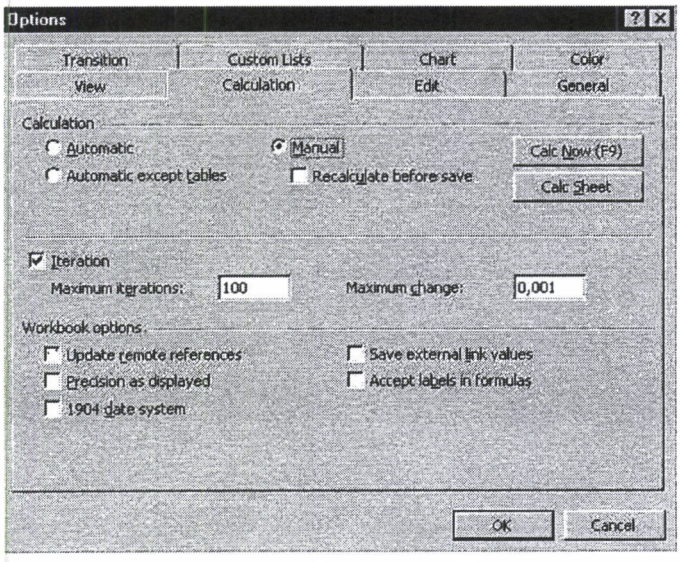
As already indicated before, the shaded cells are earmarked for keying in the required data while the other "white" cells should not be altered as they contain formulas. The PAM spreadsheets use the Excel protection function that can be activated to protect the "white" cells if the Spreadsheet has to be used by a wider audience. The activation of the Protection will allow the users to modify the value of the shaded cells only.

3.2. Setting the Calculation options in Excel.

In order to keep a consistent pattern between the computation at private and social price, the computation of the interest on revolving funds at social price also take into account the value of the commodity in process at social price. This lead in spreadsheet technique terms to a circular reference represented by dotted lines in Figure 25 and therefore to an error in the formula output.

The activation of the iteration feature in the Calculation Option panel of the spreadsheet allows solving this problem, and to complete the whole set of computations; to do so open the Tool/Option… menu and activate the Iteration and Manual Calculation option. (Figure 29)

Figure 29 Spreadsheet computation configuration



The activation of the iteration option require also to put the level of macro security at the medium level; to do so open the Tools/Macro/Security… command and select the medium level.

However, the activation of this feature, make the spreadsheet more sensitive to any mistake while entering the data, in particular at the very beginning when budgets have not been totally keyed in. Any interruption of the spreadsheet computation during the iteration process by entering a new data may result in error messages on the row allocated to revolving funds. This errors message cannot be eliminated by the cancel command.

In order to minimize the risk of having to restart the data entry on a new spreadsheet, it is recommended to turn off the automatic computation option in the option panel of the spreadsheet and the automatic saving option alike. Accordingly the user should take care of saving his work on a regular basis while entering the data.

3.3. Browsing through the spreadsheet

The size of the spreadsheet makes browsing from one cell to another rather lengthy and time consuming. In order to facilitate the access and display of important cells or range of cell, the Name box Excel feature is used. By clicking the Name box located at the left top corner of the spreadsheet, the user can directly select and display a cell or a range of cells for keying in data or reading PAM outputs (Figure 30). The list of cells' Names, corresponding, cells' references and contents are given in Table 1.

Figure 30 Name box facility for browsing.

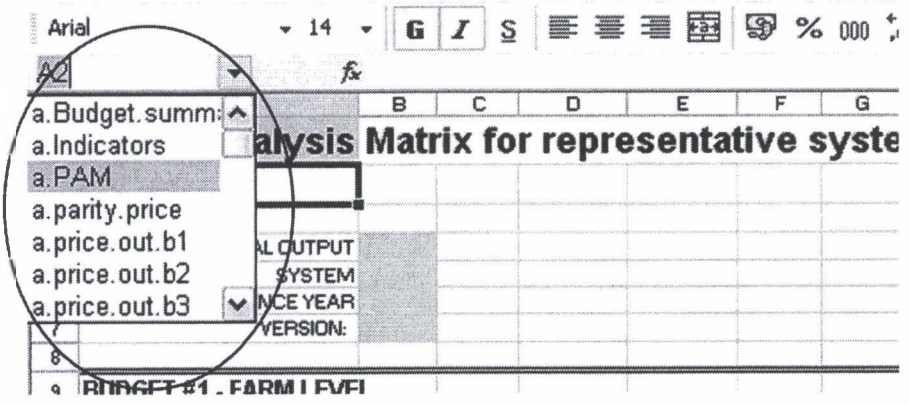


Table 1 List of cells names.

Cells Names	Cells references	Content
a.Budget.summary	=$AJ$240:$BB$280	Budget summary tables
a.Indicators	=$BD$240:$BJ$264	Indicators table
a.PAM	=$BL$259:$BT$274	Pam table
a.parity.price	='Parity price'!$E$33	Parity price cell in the Parity price spreadsheet
a.price.out.b1	=$D$48	price of the output budget 1 (Farm level)
a.price.out.b2	=$D$104	price of the output budget 2
a.price.out.b3	=$D$160	price of the output budget 3
a.price.out.b4	=$D$218	price of the output budget 4
area.unit	=$N$11	Area unit (Farm level budget)
cr.byprod.b2	=$O$63	Conversion rate from raw material to by-product budget 2
cr.byprod.b3	=$M$119	Conversion rate from raw material to by-product budget 3
cr.byprod.b4	=$N$177	Conversion rate from raw material to by-product budget 4

Cells Names	Cells references	Content
cr.output.b2	=$O$62	Conversion rate from raw material to main output budget 2
cr.output.b3	=$M$118	Conversion rate from raw material to main output budget 3
cr.output.b4	=$N$176	Conversion rate from raw material to main output budget 4
currency	=$I$11	currency unit
div.e	=$S$8	Coefficient of distortion for the exchange rate
div.L.NQ	=$S$2	Coefficient of distortion for the labor market
product.1	=$B$11	Name of the output of budget 1
product.2	=$B$62	Name of the output of budget 2
product.3	=$B$118	Name of the output of budget 3
product.4	=$B$176	Name of the output of budget 4
r.market	=$D$17	Interest rate at market price
r.social	=$E$17	Interest rate at social price
system.name	=$B$5	Name of the system
t.K	=$S$4	% tax/subsidy on the Capital market
t.losses.2	=$O$64	Rate of waste from the raw material processing budget 2
t.losses.3	=$M$120	Rate of waste from the raw material processing budget 3
t.losses.4	=$N$178	Rate of waste from the raw material processing budget 4
t.LQ	=$S$3	% of social contribution on qualified labor
unit.1	=$I$12	Unit of production for budget 1
unit.2	=$I$63	Unit of production for budget 2
unit.3	=$I$119	Unit of production for budget 3
unit.4	=$I$177	Unit of production for budget 4
world.price.FOB	='Parity price'!$D$9	World price in parity price spreadsheet
yield	=$E$48	Yield in budget 1 (Farm level)

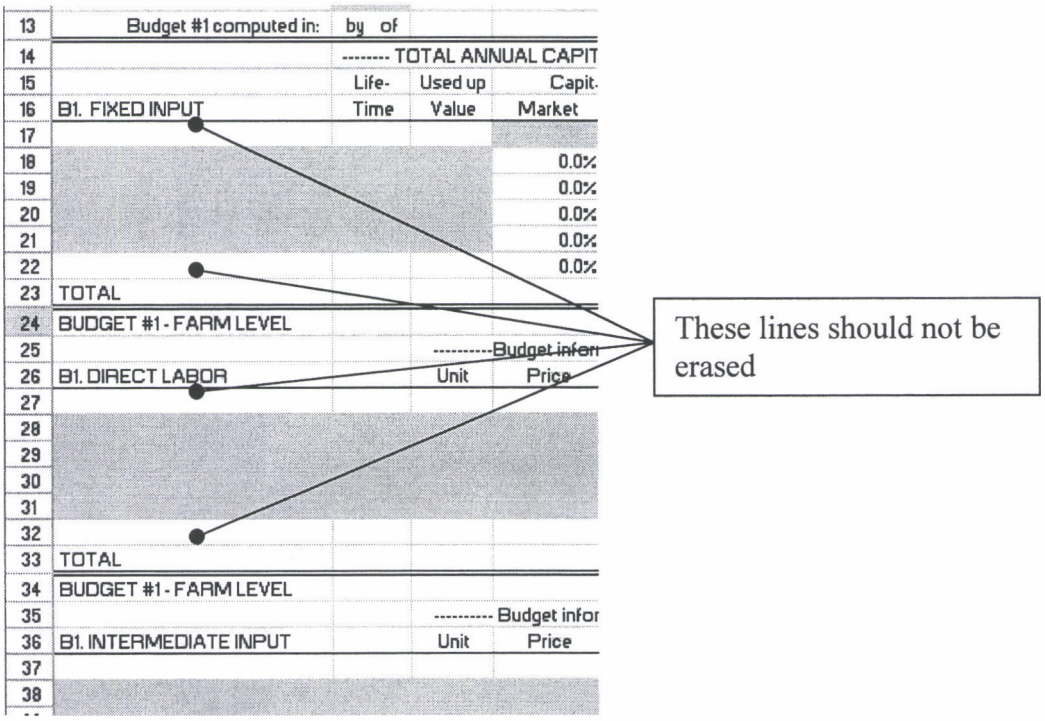
3.4. Adding or erasing budget cost item rows.

The configuration of the PAM spreadsheet allows adjusting the size of the budgets by adding or deleting the cost item rows. To keep the integrity of the formula it is important to keep the first and last rows of the budget blocks as shown in Figure 31.

To add a new row the user should select a whole row in the budget block that should be extended apart from the first and the last line of the block. The selection should be then copy and duplicated using the Insert Copied Cell of the Insert menu (or using the menu display by right clicking the mouse) If the user insert directly a new row, the formula included in the cells on the right side of the spreadsheet (like the formula for computing the coefficients of decomposition at social price) will not be copied, thus the data keyed in the new row will not be taken into account in the spreadsheet computation.

To erase a cost item row, the user selects the whole row and uses the Delete command. To remove the data in the first or last row the user should apply the Clear Content command to the shaded cell.

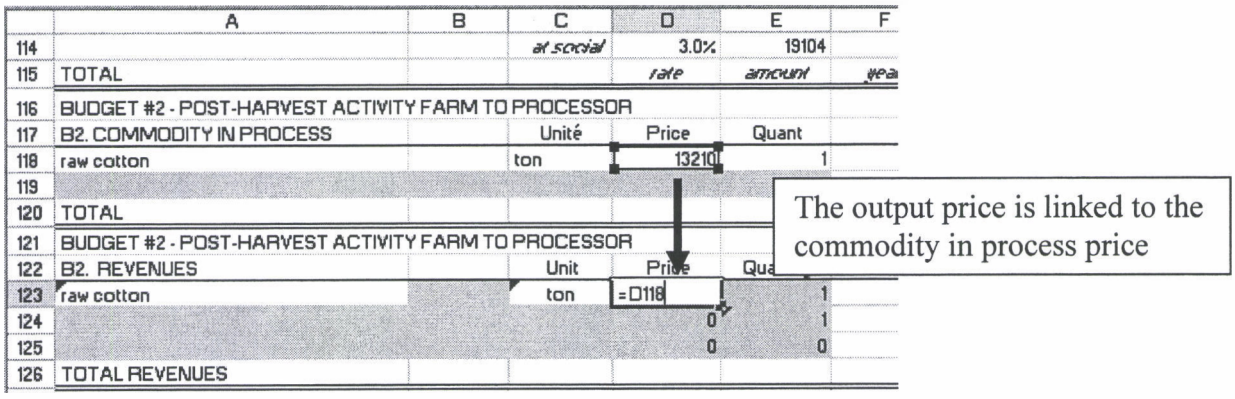
Figure 31 Adding and removing cost items lines



3.5. *Using the PAM spreadsheet with less than four budgets*

If the representation of the selected system requires using less than four budgets, the user should link the price of the main output in each empty budget to the price of the commodity in process. Similarly, all conversion ratios in each empty budget should be put to 1.

Figure 32 Linking output price to the Commodity in process price for unused budget.



4. Possible development of the basic template.

The developments of PAM spreadsheet template on standard software allows to easily adjust the template to the specific needs of the user and allows to further develop the analysis using additional and complementary computations and functions. This section will present several modifications/ adjustments and complementary computations that have been made in the context of the Comparative Advantage Study.

4.1. Spreadsheet adjustment for network irrigation costs management.

Subsidy or tax on tradable output have to be included in the Budget summary table at the bottom of the spread sheet, while subsidy on tradable input are keyed in by changing the sign of the ad-valorem and fixed tax on tradable input (i.e. a subsidy is managed by the spreadsheet as negative tax). The institutional setting along which farmers financially contribute to network irrigation operations has required adding a new feature to the spreadsheet. Farmers paid their contribution on a hectare basis and the value does not cover the entire irrigation costs (fixed cost and operation and maintenance cost).

On the private price budget side, the level of the fee paid by the farmer (3000 SP per hectare) is keyed in and adjusted to the share of the selected crop/commodity into the cropping pattern. The social value of network irrigation cost should take into account the total cost (fixed and variable) thus incorporating the subsidy component of the irrigation cost that it not bear by the farmer. The cost of network irrigation cost has been estimated at 9000 SP per hectare on the basis of information collected through NAPC studies on water.

To facilitate data entering and further modification, a specific data entry area has been added at the top of the Farm budget in order to derive the ratio between the farmer's fee value and the total irrigation cost; thus using this ratio the cost inputted in the budget at social price is adjust automatically if the level of the fee is changed. This feature is included in the model file <PAM model with irrigation cost.xls>. The farmers fee is keyed in as intermediate input cost item. The total value of the irrigation cost is keyed in a specific box at the top of the PAM spreadsheet under the Total cost heading (Figure 35). The user can then adjust by iteration the Applied ratio in the corresponding cell to equalize the cost of irrigation reported in the Social price side of the budget reported under the Social in PAM heading to the Total cost. The applied ration is used as an additional coefficient in the formula computing the social cost from the market price value of the irrigation fee value. The last adjustment is made by entering the tax paid on tradable input used in for irrigation.

Figure 33 Additional data entry area for managing irrigation fee.

	H	I	J	K	L	M	N	O	P
1									
2									
3				----------Irrigation----------					
4				Total	Share of	Ratio to	Applied	Social in	
5				cost	Tot cost	nominal	ratio	PAM	
6					0	0.000		0	
7									

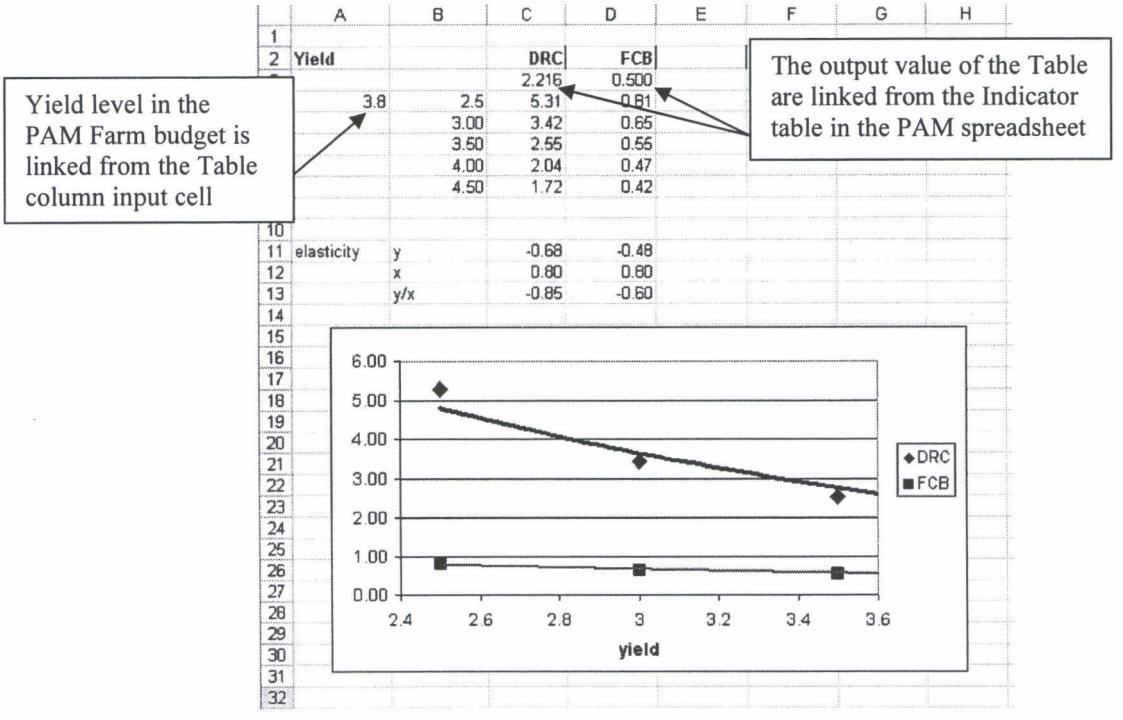
4.2. Using multiple PAM spreadsheets

It is possible to integrate into a Commodity chain PAM the result of different PAM spreadsheets corresponding to different representative systems (irrigated, rainfed…) producing the same main final outputs. The PAM for each representative system should be developed and computed separately beforehand. Then, they can be combined into the same file, and an integrated PAM can be build by adding an additional spreadsheet containing only the Summary budget and the PAMs for the whole Commodity chain. The integration is made by adding the value of each representative system summary budget weighted by a scale parameter, indicating the relative importance of each system. In the integrated PAM file, only one Parity price is used, to which each PAM spreadsheet is linked to. The integrated PAM for the cotton commodity chain is given as an example (01 Int PAM lint cotton large ginery.xls).

4.3. Sensitivity analysis with Excel table function.

Beyond breakeven values computed within the PAM spreadsheet, the sensitivity of the PAM results to any variable can be further assessed using the Table command of the Data menu (Figure 34).

Figure 34 Using the Table command for sensitivity analysis.



4.4. Introducing @Risk software for sensitivity analysis scenario simulation.

@Risk is software developed by Palisade Corporation [4] runs as an add-in to Excel and allows simulating spreadsheet formulas results for different values of input cells that varies along a selected probability distribution. This section will only provide a brief summary of its application in the context of the CAS study.

4.4.1. Launching @risk.

The software should be started first, from the Window Start menu, and it will call and open automatically Excel, while adding two additional bar of Icons on the menu area. One entitled Decisions tools could be closed (left button of the mouse on the menu bar), the second one entitled @Risk will be use to run the simulation. The file < 01 Risk PAM lint cotton netw irr large ginery.xls> can be refer to as an example.

4.4.2. Selecting input and output variables

The application of @risk requires a set of input and output variables in the Excel file that will be call by the add-in for the simulation. To the sake of easiness and safety, the selected PAM spreadsheet is saved as a new spreadsheet. An additional spreadsheet is then created in the new file called @Risk parameters (Figure 35). The selected input variables are listed at the top of this spreadsheet; these are the variables that the analyst would like to include in the @risk analysis. Likewise the output variables are listed at the bottom of the spreadsheet; these are variables for which @risk will provide a series of possible results. In the case of the PAM, macro-prices variables, output and input value or prices and technical coefficients are selected as input variables for the @Risk analysis, while the whole set of Indicators were included in the list of output.

4.4.3. Selecting the probability distribution

The following step consist in defining which probability distribution will be used to represent the values that each input variables could take in the simulation. If the purpose of the analysis is to only assess the sensitivity of PAMs' indicators to a whole set of variables varying simultaneously, a basic, simple distribution can be selected for whole set of input variables. The result will indicate which variables have a major impact on each output variable on a pure computational basis. If the purpose is to simulate to what extent the variation of a set of variables will affect the representative systems' economic performance, then it is important to select a probability distribution that corresponds to the actual observed variation of each input variables. Three type of distribution can be easily applied[5]:

> *Triang:* This function allows characterizing the variation of input variables along a triangle shape distribution providing the minimum, most likely and maximum value. This function can be used to assess the sensitivity.

[4] @Risk at http://www.palisade-europe.com/html/risk.html.

[5] For further details one can refers to the detailed presentation of probability distribution included in the @risk manual.

Betasubj: This function allows characterizing the variation of variables along an asymmetric pattern providing the minimum, most likely, mean and maximum value.

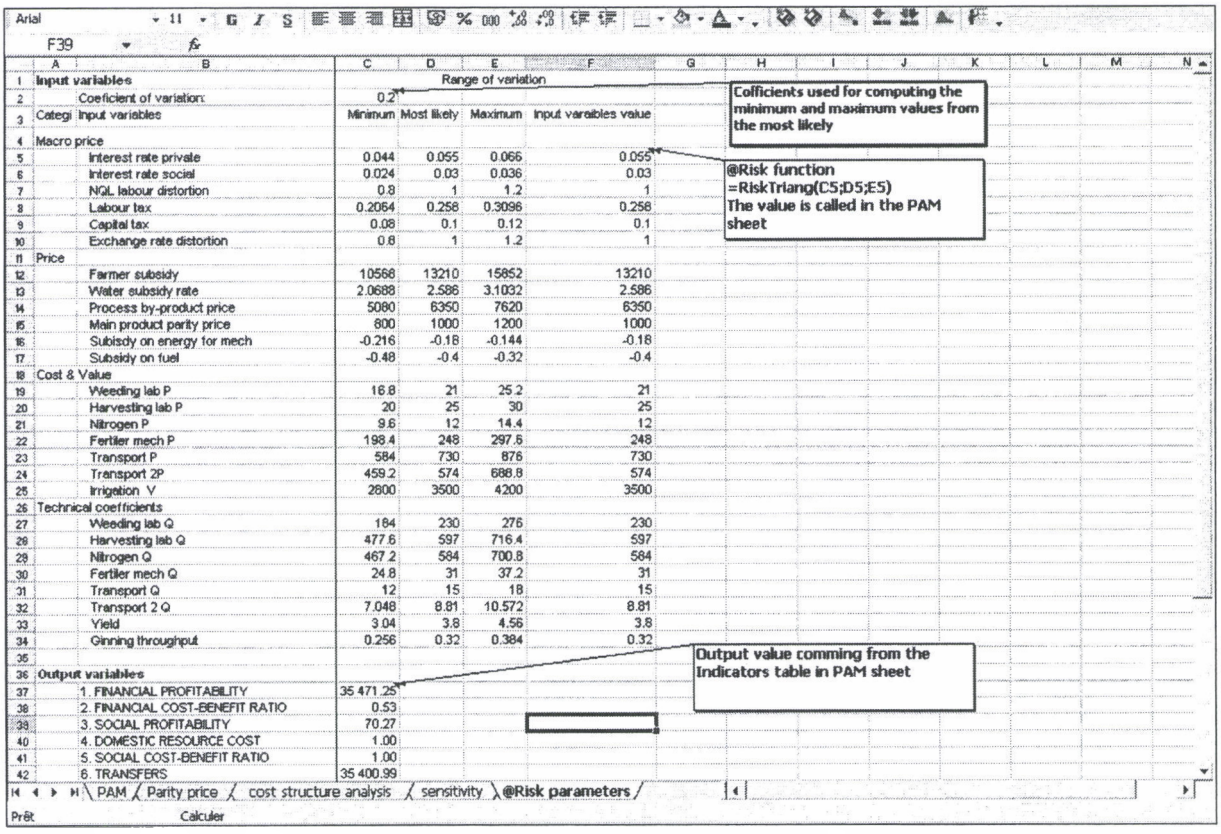
General: This function allows characterizing the variation of the variables along the pattern provided by a histogram from the observed values of the selected variable. This is the best option when it is difficult to match the actual or observed patterns of variations of the variable to a specific distribution probability.

When the appropriate distributions have been selected, the corresponding value required (i.e. maximum, minimum, most likely value…) are inputted in a specific column of the parameter spreadsheet for each input variables while the corresponding function are inputted at the end of the raw using the specific @risk function.

4.4.4. Linking the input and the output value in the PAM spreadsheet.

The last stage consists in establishing the relevant link with the PAM spreadsheet. Each cells of the PAMs spreadsheet corresponding to the value of a variable that has been included in the @risk analysis should call the corresponding cell in the @risk parameter spreadsheet. The same applies, but the other way round, for output variables.

Figure 35 @Risk parameters sheet organization.



	A	B	C	D	E	F
1	Input variables		Range of variation			
2		Coeficient of variation:	0.2			
3	Categi	Input variables	Minimum	Most likely	Maximum	Input varaibles value
4	Macro price					
5		Interest rate private	0.044	0.055	0.066	0.055
6		Interest rate social	0.024	0.03	0.036	0.03
7		NQL labour distortion	0.8	1	1.2	1
8		Labour tax	0.2064	0.258	0.3096	0.258
9		Capital tax	0.08	0.1	0.12	0.1
10		Exchange rate distortion	0.8	1	1.2	1
11	Price					
12		Farmer subsidy	10568	13210	15852	13210
13		Water subsidy rate	2.0688	2.586	3.1032	2.586
14		Process by-product price	5080	6350	7620	6350
15		Main product parity price	800	1000	1200	1000
16		Subisdy on energy for mech	-0.216	-0.18	-0.144	-0.18
17		Subsidy on fuel	-0.48	-0.4	-0.32	-0.4
18	Cost & Value					
19		Weeding lab P	16.8	21	25.2	21
20		Harvesting lab P	20	25	30	25
21		Nitrogen P	9.6	12	14.4	12
22		Fertiler mech P	198.4	248	297.6	248
23		Transport P	584	730	876	730
24		Transport 2P	459.2	574	688.8	574
25		Irrigation V	2800	3500	4200	3500
26	Technical coefficients					
27		Weeding lab Q	184	230	276	230
28		Harvesting lab Q	477.6	597	716.4	597
29		Nitrogen Q	467.2	584	700.8	584
30		Fertiler mech Q	24.8	31	37.2	31
31		Transport Q	12	15	18	15
32		Transport 2 Q	7.048	8.81	10.572	8.81
33		Yield	3.04	3.8	4.56	3.8
34		Ginning throughput	0.256	0.32	0.384	0.32
35						
36	Output variables					
37		1. FINANCIAL PROFITABILITY	35 471.25			
38		2. FINANCIAL COST-BENEFIT RATIO	0.53			
39		3. SOCIAL PROFITABILITY	70.27			
40		4. DOMESTIC RESOURCE COST	1.00			
41		5. SOCIAL COST-BENEFIT RATIO	1.00			
42		6. TRANSFERS	35 400.99			

4.4.5. Running the simulation:

The first step is to indicate to @Risk the output cells in the @Risk parameters spreadsheet. Once these are selected, they are transfers to @Risk by clic g . Then, @Risk will

identify automatically the input variables, the one that contains @Risk functions, by clicking

This action launch the @Risk screen with the list of output variable on the left and the input variables on right hand side of screen (Figure 36). At this stage before launching the simulation, the users can specify how input variables are correlated by clicking Correlate in order to make the simulation behaving as much as possible close to the reality (Figure 37).

Figure 36 @Risk input and output variable data screen

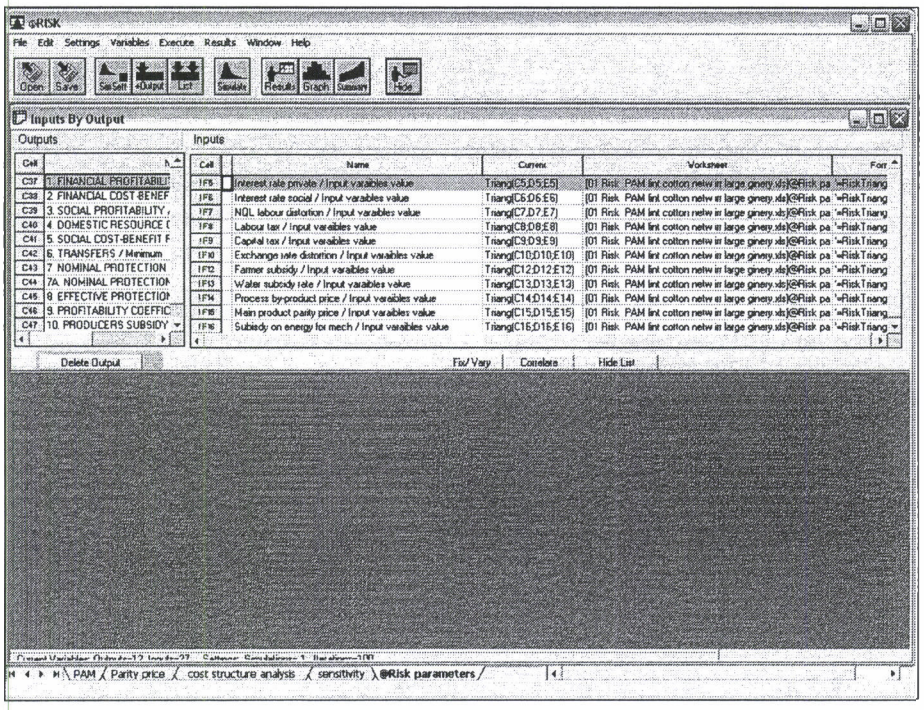
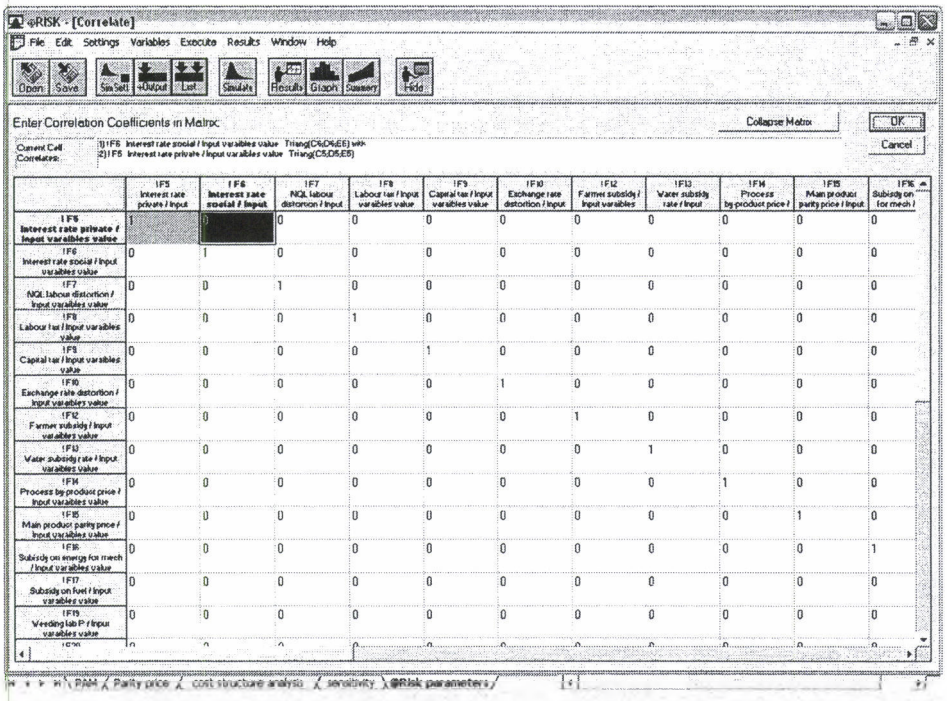


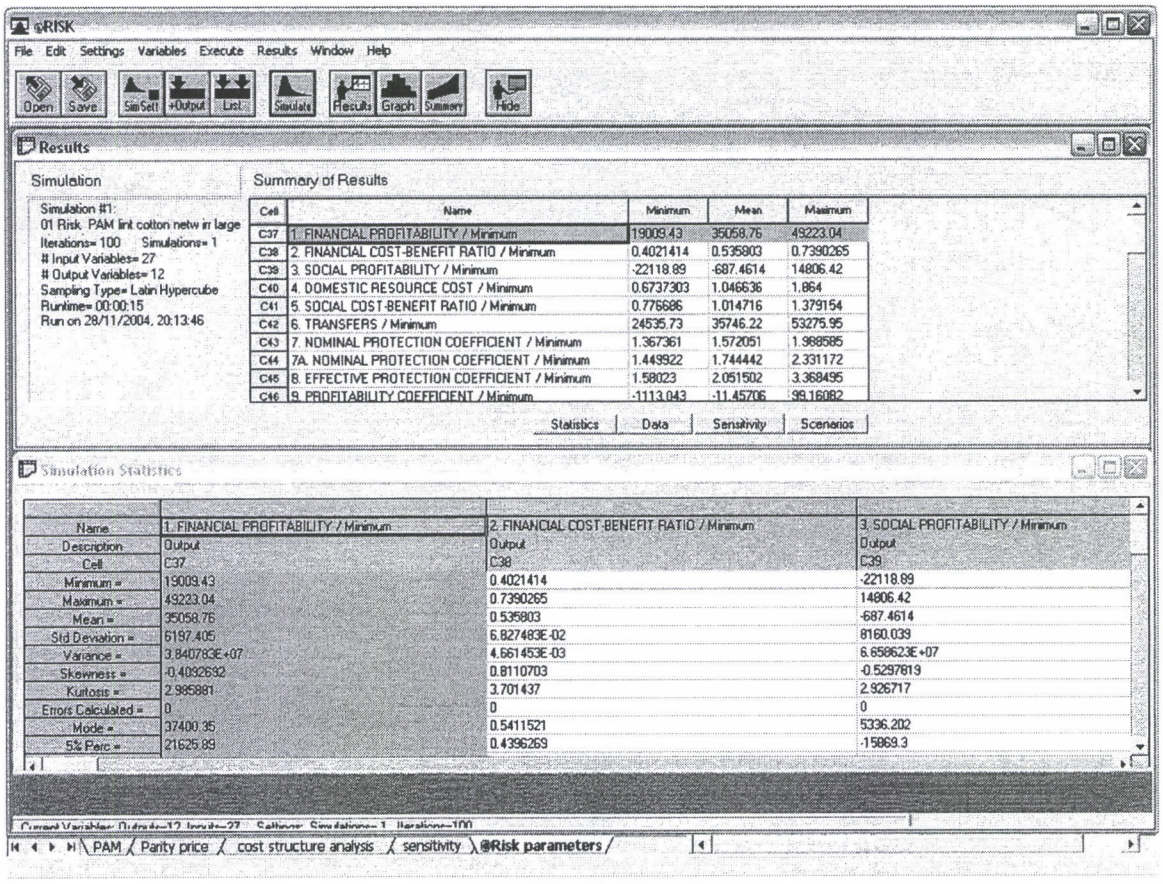
Figure 37 @Risk correlation matrix screen.



Using the correlation matrix, the analyst can specify for instance that the price of transportation is positively correlated with the price of fuel. Thus, when @Risk will generate the different input variables values within the probability distribution, it will take care to respect the coefficient of correlation keyed in.

The following step consists in launching the simulation by clicking  . During the simulation @Risk computes the PAM spreadsheet for at least 100 times (the number can be set under the setting menu) with a different set of input variables for each iteration. The results are displayed for each output variable (Figure 38).

Figure 38 : @Risk simulation output screen.



By selecting one output variable and clicking  a histogram of the distribution of the values obtained for the output variable throughout the simulations is displayed (Figure 39). A cumulated graph presents the probability to get a value above, or below a critical level. For instance in the case presented in the Figure 39, @Risk computed that there is a probability of 0.8 to get a DRC below one.

One of the interesting feature of the software is the sensitivity analysis performed simultaneously on the whole set of input variables selected. Clicking on the Sensitivity button in the result panel will generate a new set of results for each output variable (Figure 40).

Figure 39 @Risk screen of the graph presenting the probability distribution for an output.

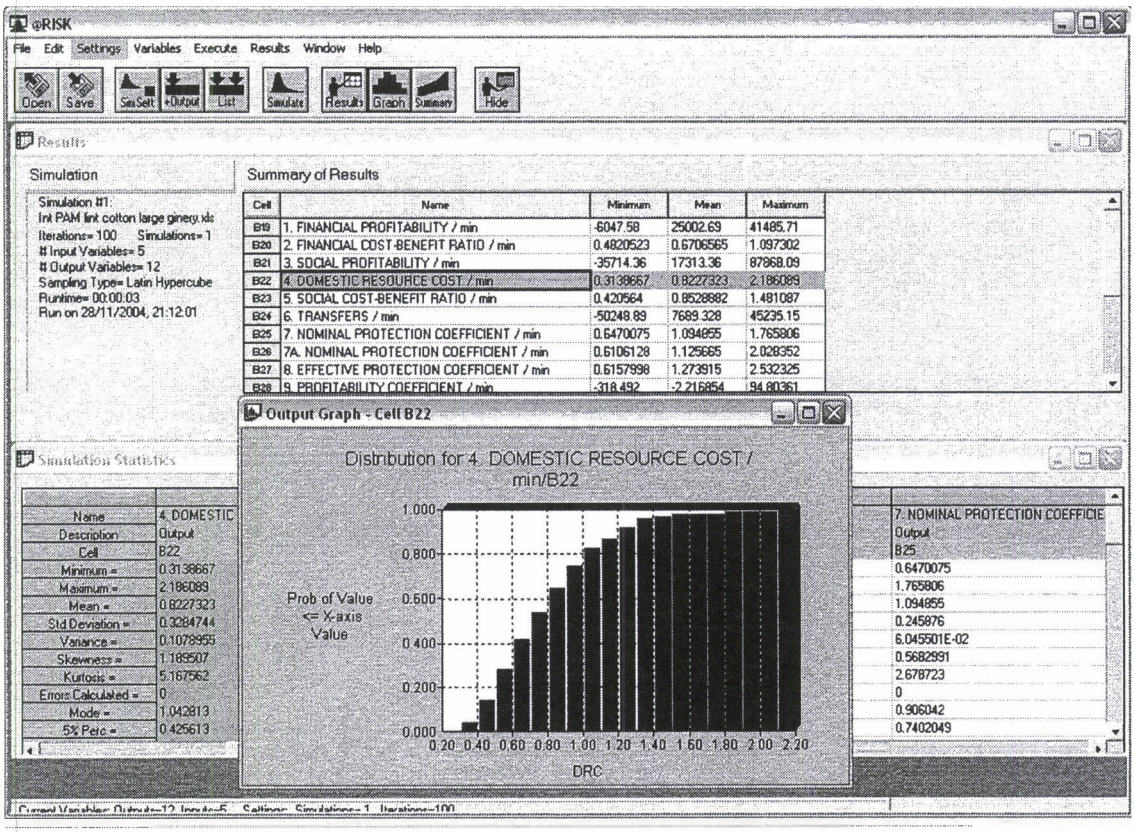
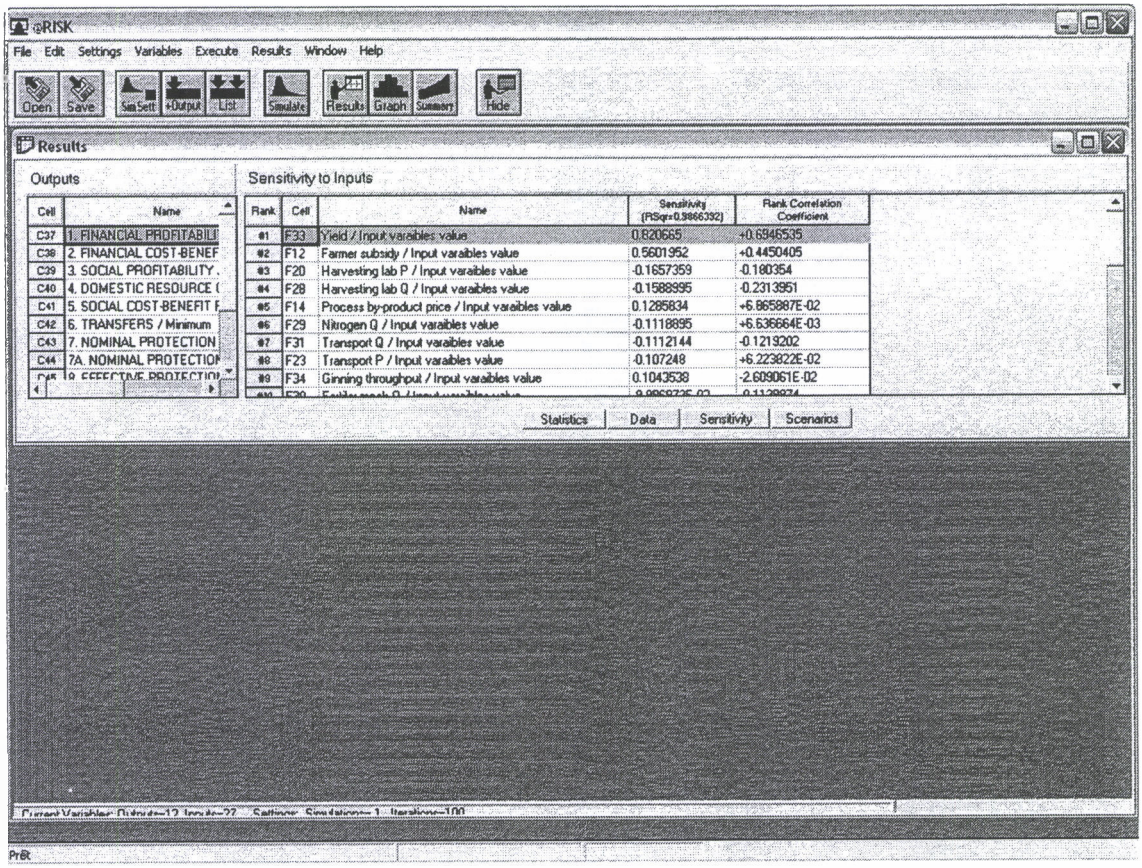
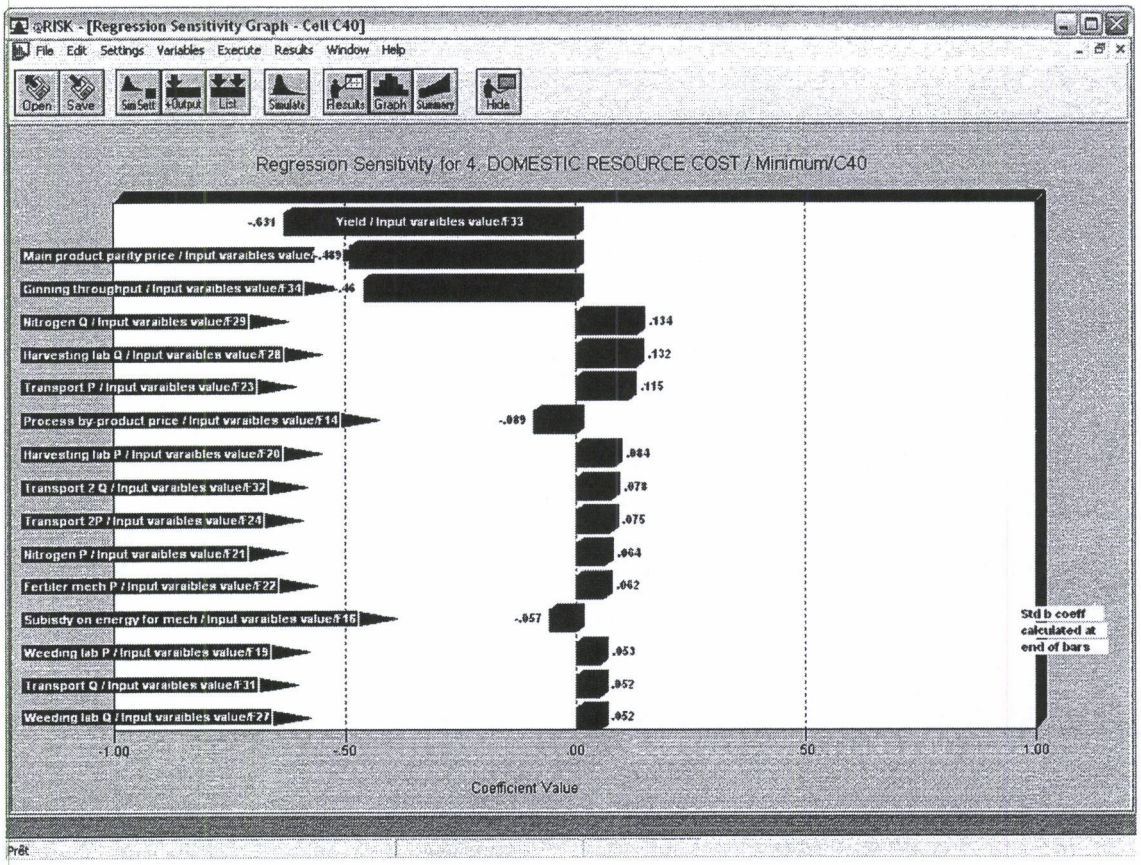


Figure 40 : @Risk screen – sensitivity analysis.



In this case also, the interpretation of the results is facilitated by the production of graphs, such as the one displayed in Figure 41 where the relative importance of the input variables on the DRC are clearly shown. It is important to underline that with @Risk the indicator of sensitivity to a given variable take into consideration the influence of other variables, whereas in the other methods proposed above such as the break even point, or the one using the Table command, the sensitivity to a given variable is measured every other input variables being equal.

Figure 41 @Risk screen - Tornado graph for sensitivity analysis.



4.5. *Establishment of a database of PAM results.*

The computation of a PAM for only one representative systems would be a rather limited input into the policy dialogue and the decision making process for agricultural policy formulation, apart from the benefit of the information collected and analyzed to build the matrix. One of the strong points of the CAS was that it dealt with a large range of products allowing comparing not only the performance at market and social price of a given representative system but also the relative performances among systems.

To facilitate the compilation of the results computed a specific file has been designed and linked[6] to the respective PAMs files to compile the different categories of result (Indicators, PAMs, Summary budget, and selected technical coefficients) in an organized and systematic form.

[6] The results database file is linked to each ¨PAM spreadsheet using the "Past with" link feature of the "Special Paste" sub-menu of the Edit menu.

The file entitled <00 PAM data summary.xls> is composed of 5 spreadsheets including:

1. *PAM datasheet:* -compiling all the results coming from the PAM computed in volume of main final output or on a hectare basis
2. *Indicators*: -listing al the different indicators from the financial profitability to Equivalent producers' subsidy.
3. *Budget in ton:* -list all the data from the summary budget computed in unit of main final output.
4. *Budget_ha*: -list all the data from the summary budget computed on a hectare basis
5. *Tech coef and margin:*- list the major technical coefficient such as yield, conversion rate, private price for the main final output and by products

The first cells at the beginning of each record recall the main features of each representative systems including:

1. *N:* the number of the PAMs
2. *Product:* the raw commodity (wheat, cotton, olive…)
3. *System:* A label specific to the system
4. *Main output:* the main final output of the representative system (flour, pasta, cotton lint, olive oil…)
5. *Parity:* the market targeted by the system (export or import)
6. *Processing:* characteristics of the post-harvest system technology and institutional status: large scale, small scale, public, private
7. *Ecology:* the type of cropping systems in which the product is grown: network irrigated rainfed...)

Samples of the spreadsheets included in the <00 PAM data Summary.xls> file are presented in Table 2 to Table 5.

Table 2 Summary spreadsheet - *PAM data* sheet sample

N	Product	System	Main output	Parity	Processing	Ecology	Unit	Price syst	Revenue	Tradable inpu	Domesctic fac	Profit
01	Cotton	Lint cotton export large ginery network	Lint cotton	export	large ginery	network	Ton main output	Private price	113 619	22 924	45 385	45 310
01	Cotton	Lint cotton export large ginery network	Lint cotton	export	large ginery	network	Ton main output	Social price	62 883	28 299	77 332	-42 748
01	Cotton	Lint cotton export large ginery network	Lint cotton	export	large ginery	network	Ton main output	Divergence	50 736	-5 376	-31 947	88 058
01	Cotton	Lint cotton export large ginery network	Lint cotton	export	large ginery	network	Hectare	Private price	138 160	27 875	55 188	55 097
01	Cotton	Lint cotton export large ginery network	Lint cotton	export	large ginery	network	Hectare	Social price	76 466	34 412	94 036	-51 982
01	Cotton	Lint cotton export large ginery network	Lint cotton	export	large ginery	network	Hectare	Divergence	61 694	-6 537	-38 848	107 079
02	Cotton	Lint cotton export large ginery well	Lint cotton	export	large ginery	well	Ton main output	Private price	109 543	23 483	58 341	27 719
02	Cotton	Lint cotton export large ginery well	Lint cotton	export	large ginery	well	Ton main output	Social price	62 870	30 318	91 535	-58 982
02	Cotton	Lint cotton export large ginery well	Lint cotton	export	large ginery	well	Ton main output	Divergence	46 673	-6 835	-33 194	86 701
02	Cotton	Lint cotton export large ginery well	Lint cotton	export	large ginery	well	Hectare	Private price	140 215	30 058	74 677	35 480
02	Cotton	Lint cotton export large ginery well	Lint cotton	export	large ginery	well	Hectare	Social price	80 474	38 807	117 165	-75 497
02	Cotton	Lint cotton export large ginery well	Lint cotton	export	large ginery	well	Hectare	Divergence	59 741	-8 748	-42 488	110 978
03	Wheat	Flour soft import public large network	Flour soft	import	public large	network	Ton main output	Private price	13 697	4 724	6 527	2 446
03	Wheat	Flour soft import public large network	Flour soft	import	public large	network	Ton main output	Social price	10 609	5 850	9 366	-4 607
03	Wheat	Flour soft import public large network	Flour soft	import	public large	network	Ton main output	Divergence	3 089	-1 125	-2 840	7 054
03	Wheat	Flour soft import public large network	Flour soft	import	public large	network	Hectare	Private price	38 353	13 228	18 275	6 850
03	Wheat	Flour soft import public large network	Flour soft	import	public large	network	Hectare	Social price	29 704	16 379	26 226	-12 900
03	Wheat	Flour soft import public large network	Flour soft	import	public large	network	Hectare	Divergence	8 648	-3 151	-7 951	19 750
..	.....	.....	.....	.....	....	.....	.....	....	....	.....		

Table 3 : Summary spreadsheet *Indicator* sheet sample

System	Main output	Parity	Processing	Ecology	Indicator	Value
01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	a. FINANCIAL PROFITABILITY	45310.11
01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	b. FINANCIAL COST-BENEFIT RATIO	0.50
01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	c. SOCIAL PROFITABILITY	-42748.17
01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	d. DOMESTIC RESOURCE COST	2.24
01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	e. SOCIAL COST-BENEFIT RATIO	1.68
01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	f. TRANSFERS	88058.34
01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	g. NOMINAL PROTECTION COEFFICIENT	1.8
01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	h. NOMINAL PROTECTION COEFFICIENT	2.04
01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	i. EFFECTIVE PROTECTION COEFFICIENT	2.62
01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	j. PROFITABILITY COEFFICIENT	-1.06
01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	k. PRODUCERS SUBSIDY RATIO	1.40
01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	l. EQUIV. PRODUCER SUBSIDY	0.78
02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	a. FINANCIAL PROFITABILITY	27718.99
02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	b. FINANCIAL COST-BENEFIT RATIO	0.68
02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	c. SOCIAL PROFITABILITY	-58982.23
02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	d. DOMESTIC RESOURCE COST	2.81
02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	e. SOCIAL COST-BENEFIT RATIO	1.94
02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	f. TRANSFERS	86701.21
02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	g. NOMINAL PROTECTION COEFFICIENT	1.74
02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	h. NOMINAL PROTECTION COEFFICIENT	1.96
02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	i. EFFECTIVE PROTECTION COEFFICIENT	2.64
02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	j. PROFITABILITY COEFFICIENT	-0.47
02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	k. PRODUCERS SUBSIDY RATIO	1.38
02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	l. EQUIV. PRODUCER SUBSIDY	0.79
03 PAM Flour soft import public large network	Flour soft	import	public large	network	a. FINANCIAL PROFITABILITY	2446.42
03 PAM Flour soft import public large network	Flour soft	import	public large	network	b. FINANCIAL COST-BENEFIT RATIO	0.73
03 PAM Flour soft import public large network	Flour soft	import	public large	network	c. SOCIAL PROFITABILITY	-4607.27
03 PAM Flour soft import public large network	Flour soft	import	public large	network	d. DOMESTIC RESOURCE COST	1.97
03 PAM Flour soft import public large network	Flour soft	import	public large	network	e. SOCIAL COST-BENEFIT RATIO	1.43
03 PAM Flour soft import public large network	Flour soft	import	public large	network	f. TRANSFERS	7053.69
03 PAM Flour soft import public large network	Flour soft	import	public large	network	g. NOMINAL PROTECTION COEFFICIENT	1.29
03 PAM Flour soft import public large network	Flour soft	import	public large	network	h. NOMINAL PROTECTION COEFFICIENT	1.33
03 PAM Flour soft import public large network	Flour soft	import	public large	network	i. EFFECTIVE PROTECTION COEFFICIENT	1.89
03 PAM Flour soft import public large network	Flour soft	import	public large	network	j. PROFITABILITY COEFFICIENT	-0.53
03 PAM Flour soft import public large network	Flour soft	import	public large	network	k. PRODUCERS SUBSIDY RATIO	0.66
03 PAM Flour soft import public large network	Flour soft	import	public large	network	l. EQUIV. PRODUCER SUBSIDY	0.51
...	...	....	....	....	...	...

Table 4: Summary spreadsheet *Budget_Ton* sheet sample

Nb	Product	System	Main output	Parity	Processing	Ecology	Item	MkFARM	Mk#2	Mk#3	Mk#4	Mk post FARM	Mk System	SoFARM	So#2	So#3	So#4	So post FARM	So System	DiFarm	Di#2	Di#3	Di#4	Di FARM	Di System
01	Cotton	01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	1 TOTAL REVENUES	86 851	41 281	68 049	54 075	68 049	113 619	59 957	59 699	62 170	48 652	62 626	62 883	26 895	-18 418	5 879	5 423	5 423	50 736
01	Cotton	01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	1a Main final ouput	41 281	41 281	54 075	54 075	54 075	54 075	59 699	59 699	48 196	48 652	48 652	48 652	-16 418	-18 418	5 879	5 423	5 423	5 423
01	Cotton	01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	1b By-products	258	0	13 974	0	13 974	14 231	258	0	13 974	0	13 974	14 231	0	0	0	0	0	0
01	Cotton	01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	2. TOTAL COST	85 321	41 281	43 850	54 468	44 269	68 308	100 684	59 699	82 170	48 652	82 886	105 831	-37 343	-18 418	-18 320	5 814	-18 397	37 323
01	Cotton	01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	2a Commodity in process	0	41 281	41 281	54 075	41 281	0	0	59 699	59 699	48 196	59 699	0	0	-18 418	-18 418	5 879	-18 418	0
01	Cotton	01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	2b (tax+, subsidy-)	-45 313	0	0	0	0	-45 313	0	0	0	0	0	0	0	0	0	0	0	0
01	Cotton	01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	2c Tradables	21 990	0	621	313	934	22 924	27 126	0	792	381	1 174	28 299	-5 136	0	-171	-69	-240	-5 376
01	Cotton	01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	2d Domestic Factors	43 331	0	1 975	78	2 054	45 385	75 538	0	1 718	74	1 794	77 332	-32 207	0	256	4	260	-31 947
01	Cotton	01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	2di Unskilled Labor	28 947	0	837	20	857	29 804	29 860	0	835	20	855	30 815	-1 013	0	2	0	2	-1 011
01	Cotton	01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	2dii Skilled Labor	1 933	0	268	20	287	2 220	1 720	0	212	16	228	1 948	213	0	55	4	59	272
01	Cotton	01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	2diii Capital	12 451	0	870	39	910	13 361	43 859	0	672	39	711	44 569	-31 408	0	199	0	199	-31 209
01	Cotton	01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	4a PROFIT BEFORE-TAXES	21 530	0	24 199	-391	23 780	45 310	-42 708	0	0	0	0	-42 748	64 238	0	24 199	-391	23 820	88 058
01	Cotton	01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	4b Dircet taxes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01	Cotton	01 PAM Lint cotton export large ginery network	Lint cotton	export	large ginery	network	4c PROFIT AFTER-TAXES	-23 782	0	24 199	-391	23 808	45 310	0	0	0	0	0	0	(po	0	0	0	0	0
02	Cotton	02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	1 TOTAL REVENUES	86 807	45 313	68 049	54 075	68 049	109 543	59 986	59 741	62 200	48 652	62 626	62 870	26 821	-14 429	5 849	5 423	5 423	46 673
02	Cotton	02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	1a Main final ouput	45 313	45 313	54 075	54 075	54 075	54 075	59 741	59 741	48 226	48 652	48 652	48 652	-14 429	-14 429	5 849	5 423	5 423	5 423
02	Cotton	02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	1b By-products	245	0	13 974	0	13 974	14 218	245	0	13 974	0	13 974	14 218	0	0	0	0	0	0
02	Cotton	02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	2. TOTAL COST	79 189	45 313	47 952	54 466	48 343	81 824	119 117	59 741	62 200	48 652	62 824	121 852	-39 928	-14 429	-14 248	5 814	-14 281	40 028
02	Cotton	02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	2a Commodity in process	0	45 313	45 313	54 075	45 313	0	0	59 741	59 741	48 226	59 741	0	0	-14 429	-14 429	5 849	-14 429	0
02	Cotton	02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	2b (tax+, subsidy-)	-41 250	0	0	0	0	-41 250	0	0	0	0	0	0	0	0	0	0	0	0
02	Cotton	02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	2c Tradables	22 617	0	690	176	866	23 483	29 271	0	833	215	1 047	30 318	-6 853	0	-143	-39	-181	-6 835
02	Cotton	02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	2d Domestic Factors	56 177	0	1 949	215	2 164	58 341	89 899	0	1 625	211	1 836	91 535	-33 522	0	325	4	329	-33 194
02	Cotton	02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	2di Unskilled Labor	30 537	0	837	129	966	31 504	30 537	0	834	129	963	31 501	0	0	3	0	3	3
02	Cotton	02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	2dii Skilled Labor	865	0	214	20	233	1 098	688	0	169	16	185	872	177	0	45	4	49	226
02	Cotton	02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	2diii Capital	24 774	0	898	66	965	25 739	58 474	0	621	86	688	59 162	-33 700	0	277	0	277	-33 423
02	Cotton	02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	4a PROFIT BEFORE-TAXES	7 618	0	20 097	-391	19 706	27 719	-59 131	0	0	0	0	-58 982	68 749	0	20 097	-391	19 704	86 701
02	Cotton	02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	4b Dircet taxes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02	Cotton	02 PAM Lint cotton export large ginery well	Lint cotton	export	large ginery	well	4c PROFIT AFTER-TAXES	-33 632	0	20 097	-391	19 706	27 719	0	0	0	0	0	0	(po	0	0	0	0	0
03	Wheat	03 PAM Flour soft import public large network	Flour soft	import	public large	network	1 TOTAL REVENUES	13 204	13 125	13 618	7 200	8 450	13 697	10 172	10 092	10 529	9 278	10 529	10 609	3 033	3 033	3 089	-2 079	-2 079	3 089
03	Wheat	03 PAM Flour soft import public large network	Flour soft	import	public large	network	1a Main final ouput	13 125	13 125	7 200	7 200	7 200	7 200	10 092	10 092	9 278	9 278	9 279	9 279	3 033	3 033	-2 079	-2 079	-2 079	-2 079
03	Wheat	03 PAM Flour soft import public large network	Flour soft	import	public large	network	1b By-products	79	0	1 250	0	1 250	1 329	78	0	1 250	0	1 250	1 328	0	0	0	0	0	0
03	Wheat	03 PAM Flour soft import public large network	Flour soft	import	public large	network	2. TOTAL COST	10 758	13 125	13 618	7 200	13 818	11 251	14 780	10 092	10 529	9 279	10 529	15 218	4 022	3 033	3 089	-2 079	3 090	3 965
03	Wheat	03 PAM Flour soft import public large network	Flour soft	import	public large	network	2a Commodity in process	0	13 125	13 125	7 200	13 125	0	0	10 092	10 092	9 279	10 092	0	0	3 033	3 033	-2 079	3 033	0
03	Wheat	03 PAM Flour soft import public large network	Flour soft	import	public large	network	2b (tax+, subsidy-)	0	0	-5 168	0	-5 168	-5 168	0	0	0	0	0	0	0	0	0	0	0	0
03	Wheat	03 PAM Flour soft import public large network	Flour soft	import	public large	network	2c Tradables	4 597	0	127	0	127	4 724	5 887	0	163	0	163	5 850	-1 089	0	-38	0	-36	-1 125
03	Wheat	03 PAM Flour soft import public large network	Flour soft	import	public large	network	2d Domestic Factors	8 160	0	368	0	368	8 527	9 093	0	273	0	273	9 366	-2 933	0	93	0	93	-2 840
03	Wheat	03 PAM Flour soft import public large network	Flour soft	import	public large	network	2di Unskilled Labor	2 050	0	95	0	95	2 146	2 344	0	93	0	93	2 437	-293	0	2	0	2	-291
03	Wheat	03 PAM Flour soft import public large network	Flour soft	import	public large	network	2dii Skilled Labor	371	0	153	0	153	524	348	0	121	0	121	469	23	0	32	0	32	55
03	Wheat	03 PAM Flour soft import public large network	Flour soft	import	public large	network	2diii Capital	3 738	0	119	0	119	3 857	6 401	0	60	0	60	6 461	-2 663	0	59	0	59	-2 604
03	Wheat	03 PAM Flour soft import public large network	Flour soft	import	public large	network	4a PROFIT BEFORE-TAXES	2 447	0	0	0	-5 168	2 446	-4 608	0	0	0	0	-4 607	7 055	0	0	0	-5 169	7 054
03	Wheat	03 PAM Flour soft import public large network	Flour soft	import	public large	network	4b Dircet taxes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03	Wheat	03 PAM Flour soft import public large network	Flour soft	import	public large	network	4c PROFIT AFTER-TAXES	2 447	0	-5 168	0	-5 168	2 446	0	0	0	0	0	0	(po	0	0	0	0	0

MkFARM : Summary budget market price values for Farm budget
Mk#2 : Summary budget market price values for Farm to Processor budget
Mk#3 : Summary budget market price values for Processing budget
Mk#4 : Summary budget market price values for Processing to wholesale budget
Mk post FARM : Summary budget market price values for Post-Farm budget
Mk System : Summary budget market price values for the wholes representative system

SoFARM : Summary budget social price values for Farm budget
So#2 : Summary budget social price values for Farm to Processor budget
So#3 : Summary budget social price values for Processing budget
So#4 : Summary budget social price values for Processing to wholesale budget
So post FARM : Summary budget social price values for Post-Farm budget
So System : Summary budget social price values for the wholes representative system

DiFARM : Summary budget social price - market price divergence values for Farm budget
Di#2 : Summary budget social price - market price divergence values for Farm to Processor budget
Di#3 : Summary budget social price - market price divergence values for Processing budget
Di#4 : Summary budget social price - market price divergence values for Processing to wholesale budget
Di post FARM : Summary budget social price - market price divergence values for Post-Farm budget (Di#2+Di#3+Di#4)

Di System : Summary budget social price - market price divergence values for the wholes representative system

Table 5 : Summary spreadsheet *Tech coef and margin sheet* sample

Nb	Product	System	Main output	Parity	Processing	Ecology	Yield	FB MO	FB by prod	#2 MO	Conv.rate	Conv.rate BP	#3 MO	#3 BP	Parity price
1	Cotton	Lint cotton export large ginery network	Lint cotton	export	large ginery	network	3.80	13 210	80	13 210	0.32	0.63	54 075	6 350	950
2	Cotton	Lint cotton export large ginery well	Lint cotton	export	large ginery	well	4.00	14 500	80	14 500	0.32	0.63	54 075	6 350	950
3	Wheat	Flour soft import public large network	Flour soft	import	public large	network	3.50	10 500	66 666	10 500	0.80	0.20	7 200	5 000	171
4	Wheat	Flour soft import public large well	Flour soft	import	public large	well	4.30	10 500	0	10 500	0.80	0.20	7 200	5 000	171
5	Wheat	Flour soft import public large rainfed	Flour soft	import	public large	rainfed	2.30	10 208	16 667	10 208	0.80	0.20	7 200	5 000	170
6	Wheat	Flour hard import public large network	Flour hard	import	public large	network	3.90	10 706	137 500	10 706	0.80	0.20	7 200	5 000	198
7	Wheat	Flour hard import public large well	Flour hard	import	public large	well	4.10	10 604	24 643	10 604	0.80	0.20	7 200	5 000	198
8	Wheat	Flour hard import public large rainfed	Flour hard	import	public large	rainfed	2.88	10 604	12 842	10 500	0.80	0.20	7 200	5 000	198
9	Wheat	Flour soft import public small network	Flour soft	import	public small	network	3.50	10 500	66 667	10 500	0.80	0.20	7 200	5 000	170
10	Wheat	Flour soft import private network	Flour soft	import	private	network	3.50	9 500	66 667	10 500	0.70	0.28	14 500	6 000	187
11	Wheat	Pasta low export pasta factory network	Pasta low	export	pasta factory	network	4.18	10 604		11 500	0.68	0.30	25 000	6 000	400
12	Wheat	Pasta low export pasta factory well	Pasta low	export	pasta factory	well	3.99	10 604	24 643	11 500	0.68	0.30	25 000	6 000	400
13	Wheat	Pasta low export pasta factory rainfed	Pasta low	export	pasta factory	rainfed	2.88	10 604	12 842	11 500	0.68	0.30	25 000	6 000	400

Yield : yield imputed in the Farm budget
FB MO : Farm budget main output market price
FB by prod : Farm Budget by product market price
#2 MO : Budget #2 (Farm to processor) Main Output market price
Conv.rate : Conversion rate from the selected commodity in raw form (Farm budget and Budget#2) to processed form
Conv.rate BP : Conversion rate for main by product ate Budget #3 - Processing
#3 MO : Budget #3 (Processing) Main Output market price
#3 BP : Budget #3 (Processing) Main By-Product market price
Parity price : Main final output international price use to compute the parity price.

This data set of results can be further analyzed with the "filter" and "pivot" commands of the spreadsheet to extract a particular sample of results and build graphs that will assist in analyzing, comparing and presenting the results to a larger audience as display in Figure 42 in Figure 43.

Figure 42 : Example of Pivot Table Graph output for comparing DRCs level across representative systems.

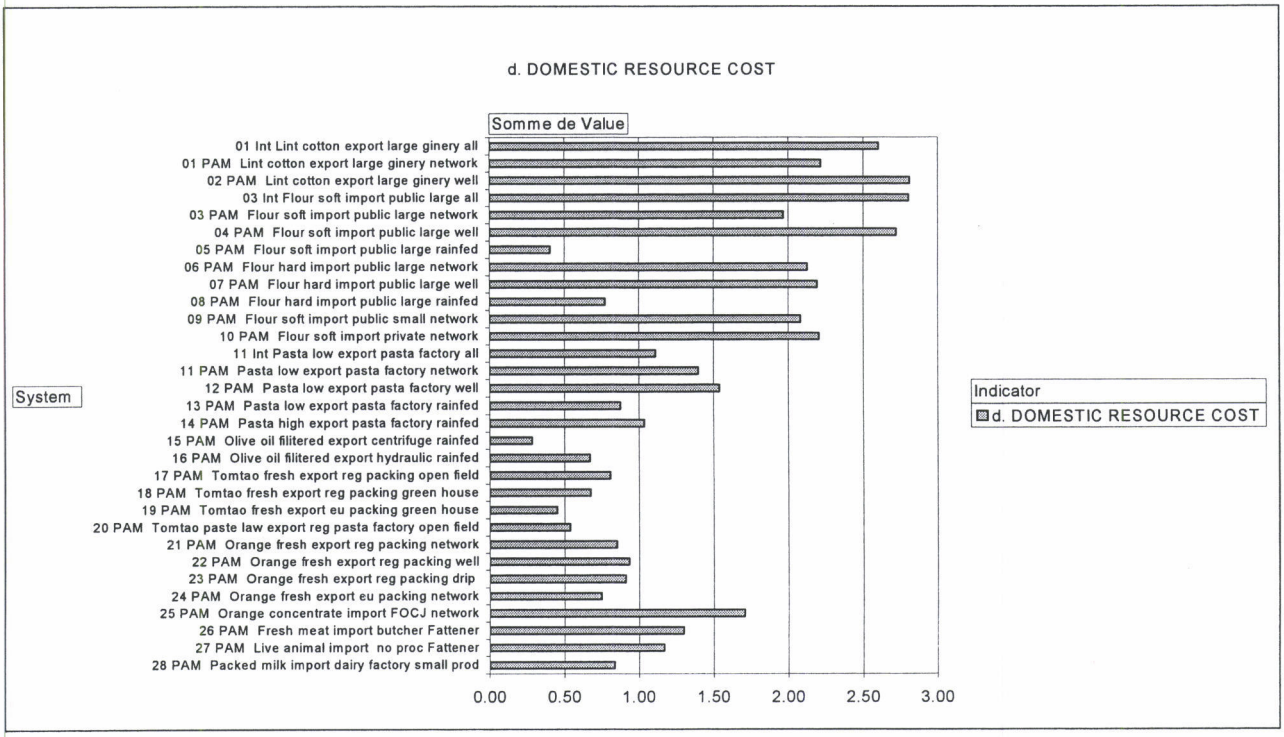
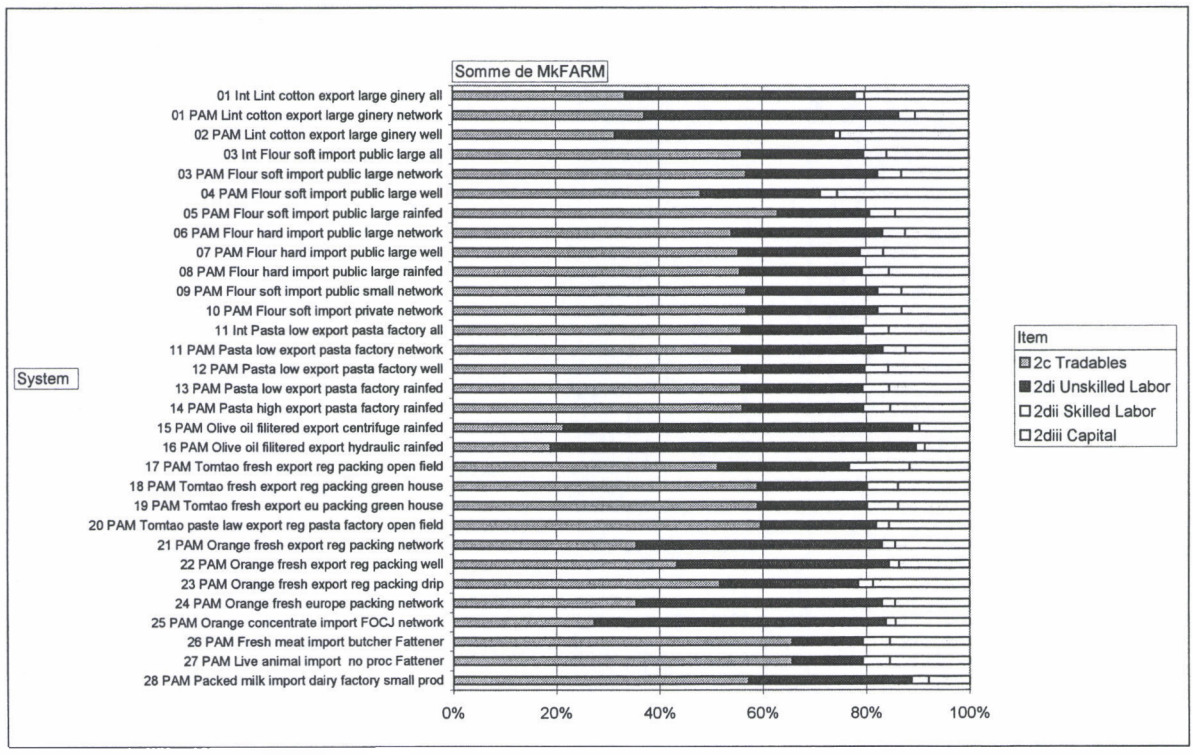
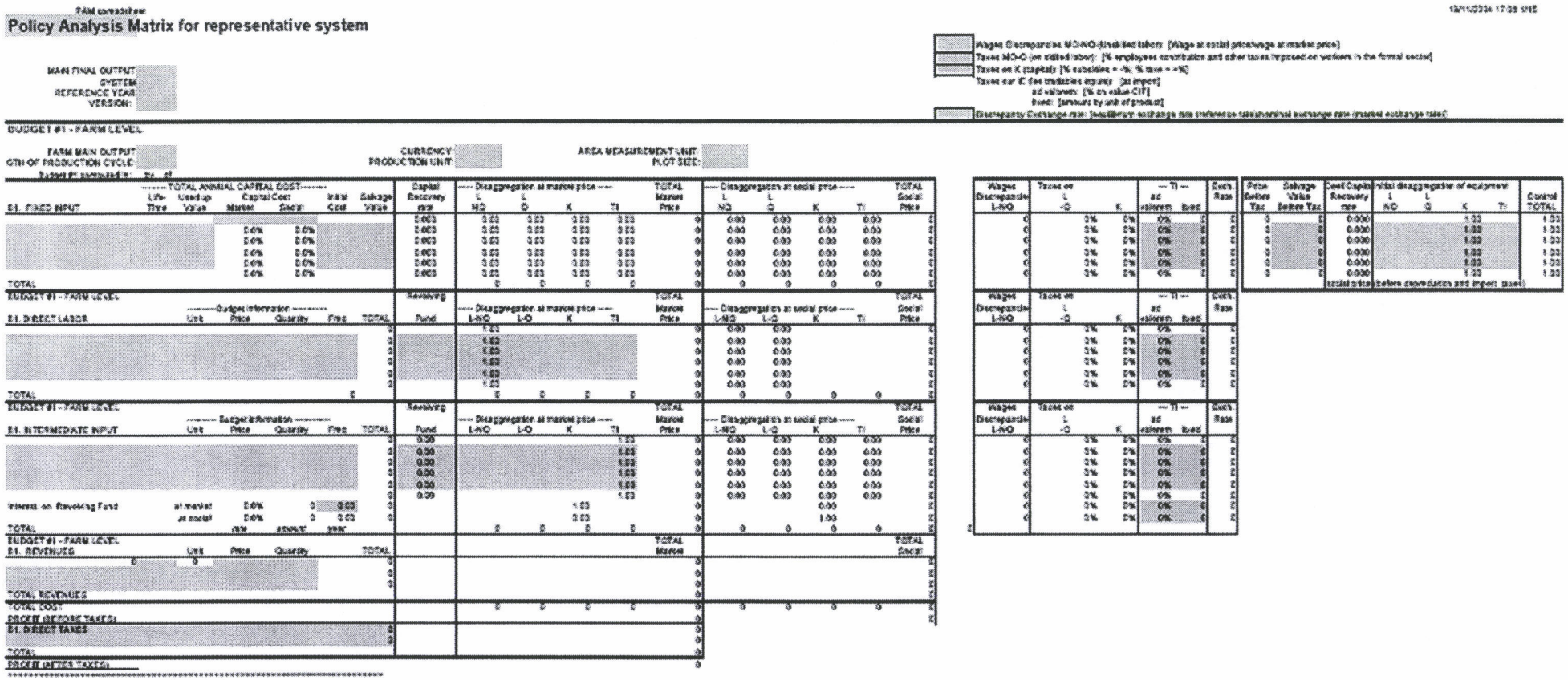
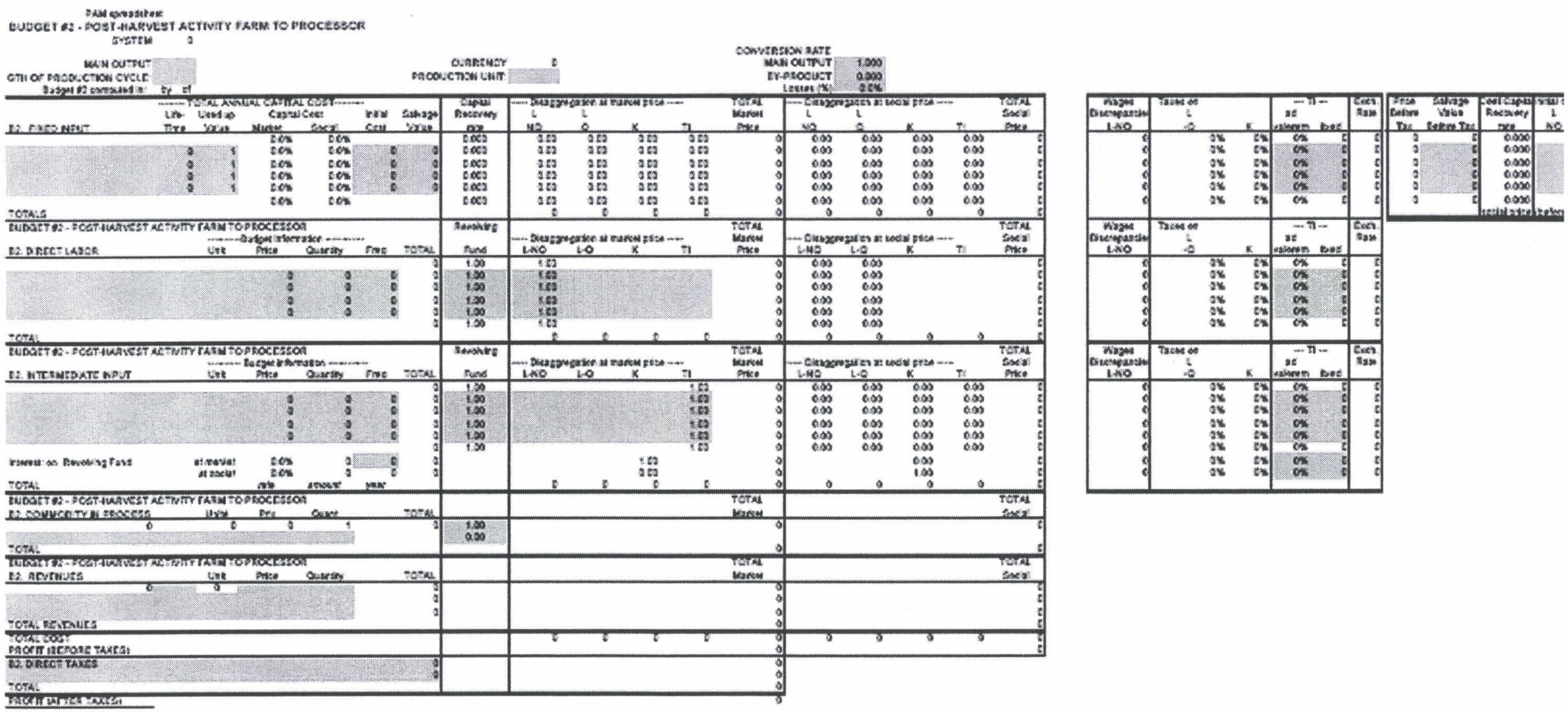


Figure 43 : Example of Pivot Table Graph output for comparing DRCs level across representative systems.


Somme de MkFARM
System
01 Int Lint cotton export large ginery all
01 PAM Lint cotton export large ginery network
02 PAM Lint cotton export large ginery well
03 Int Flour soft import public large all
03 PAM Flour soft import public large network
04 PAM Flour soft import public large well
05 PAM Flour soft import public large rainfed
06 PAM Flour hard import public large network
07 PAM Flour hard import public large well
08 PAM Flour hard import public large rainfed
09 PAM Flour soft import public small network
10 PAM Flour soft import private network
11 Int Pasta low export pasta factory all
11 PAM Pasta low export pasta factory network
12 PAM Pasta low export pasta factory well
13 PAM Pasta low export pasta factory rainfed
14 PAM Pasta high export pasta factory rainfed
15 PAM Olive oil filitered export centrifuge rainfed
16 PAM Olive oil filitered export hydraulic rainfed
17 PAM Tomtao fresh export reg packing open field
18 PAM Tomtao fresh export reg packing green house
19 PAM Tomtao fresh export eu packing green house
20 PAM Tomtao paste law export reg pasta factory open field
21 PAM Orange fresh export reg packing network
22 PAM Orange fresh export reg packing well
23 PAM Orange fresh export reg packing drip
24 PAM Orange fresh europe packing network
25 PAM Orange concentrate import FOCJ network
26 PAM Fresh meat import butcher Fattener
27 PAM Live animal import no proc Fattener
28 PAM Packed milk import dairy factory small prod
0%
20%
40%
60%
80%
100%
Item
2c Tradables
2di Unskilled Labor
2dii Skilled Labor
2diii Capital

Appendix A. PAM Spreadsheet




PAM spreadsheet
BUDGET #2 - POST-HARVEST ACTIVITY FARM TO PROCESSOR
SYSTEM 3
MAIN OUTPUT
GTH OF PRODUCTION CYCLE
CURRENCY
PRODUCTION UNIT
CONVERSION RATE
MAIN OUTPUT 1.000
BY-PRODUCT 0.000
Losses (%) 0.0%
TOTAL ANNUAL CAPITAL COST
Life-Time
Used up Value
Capital Cost
Market
Social
Initial Cost
Salvage Value
Capital Recovery
B2. FIXED INPUT
TOTALS
B2. DIRECT LABOR
Budget information
Unit
Price
Quantity
Freq
TOTAL
Revolving Fund
Disaggregation at market price
L-NO
L-O
K
TI
TOTAL Market Price
Disaggregation at social price
TOTAL Social Price
Wages Discrepancies L-NO
Taxes on L-O
ad valorem
fixed
Exch. Rate
B2. INTERMEDIATE INPUT
Interest on Revolving Fund
at market
at social
rate
amount
year
B2. COMMODITY IN PROCESS
B2. REVENUES
TOTAL REVENUES
TOTAL COST
PROFIT (BEFORE TAXES)
B2. DIRECT TAXES
PROFIT (AFTER TAXES)

PAM spreadsheet

BUDGET #3 - POST-HARVEST ACTIVITY PROCESSING
SYSTEM 3

MAIN OUTPUT
GTH OF PRODUCTION CYCLE
Budget #3 computed in: by of

CURRENCY 3
PRODUCTION UNIT

CONVERSION RATE
MAIN OUTPUT 1.00
BY-PRODUCT 0.00
Losses (%) 0.0%

CAPACITY
CAPACITY UTILISATION

B3. FIXED INPUT	Life-Time	Used up Value	Capital Cost Market	Capital Cost Social	Initial Cost	Salvage Value	Capital Recovery rate	L-NO (market)	L-O (market)	K (market)	TI (market)	TOTAL Market Price	L-NO (social)	L-O (social)	K (social)	TI (social)	TOTAL Social Price
			0.0%	0.0%			0.000	[illegible]	[illegible]	[illegible]	[illegible]	0	0.00	0.00	0.00	0.00	0
			0.0%	0.0%		0	0.000	[illegible]	[illegible]	[illegible]	[illegible]	0	0.00	0.00	0.00	0.00	0
			0.0%	0.0%		0	0.000	[illegible]	[illegible]	[illegible]	[illegible]	0	0.00	0.00	0.00	0.00	0
			0.0%	0.0%		0	0.000	[illegible]	[illegible]	[illegible]	[illegible]	0	0.00	0.00	0.00	0.00	0
			0.0%	0.0%		0	0.000	[illegible]	[illegible]	[illegible]	[illegible]	0	0.00	0.00	0.00	0.00	0
			0.0%	0.0%			0.000	[illegible]	[illegible]	[illegible]	[illegible]	0	0.00	0.00	0.00	0.00	0
TOTALS								0	0	0	0	0	0	0	0	0	0

BUDGET #3 - POST-HARVEST ACTIVITY PROCESSING

B3. DIRECT LABOR	Unit	Price	Quantity	Freq.	TOTAL	Revolving Fund	L-NO (market)	L-O (market)	K (market)	TI (market)	TOTAL Market Price	L-NO (social)	L-O (social)	K (social)	TI (social)	TOTAL Social Price
					0	0.00	1.00				0	0.00	0.00			0
					0	0.00	1.00				0	0.00	0.00			0
					0	0.00	1.00				0	0.00	0.00	0.00	0.00	0
					0	0.00	1.00				0	0.00	0.00	0.00	0.00	0
					0	0.00	1.00				0	0.00	0.00	0.00	0.00	0
					0	0.00	1.00				0	0.00	0.00			0
TOTALS							0	0	0	0	0	0	0	0	0	0

BUDGET #3 - POST-HARVEST ACTIVITY PROCESSING

B3. INTERMEDIATE INPUT	Unit	Price	Quantity	Freq.	TOTAL	Revolving Fund	L-NO (market)	L-O (market)	K (market)	TI (market)	TOTAL Market Price	L-NO (social)	L-O (social)	K (social)	TI (social)	TOTAL Social Price
					0	0.00				1.00	0	0.00	0.00	0.00	0.00	0
					0	0.00				1.00	0	0.00	0.00	0.00	0.00	0
					0	0.00				1.00	0	0.00	0.00	0.00	0.00	0
					0	0.00				1.00	0	0.00	0.00	0.00	0.00	0
					0	0.00				1.00	0	0.00	0.00	0.00	0.00	0
					0	0.00				1.00	0	0.00	0.00	0.00	0.00	0
Interest on Revolving Fund	at market	0.0%	0		0				1.00		0			0.00		0
	at social	0.0%	0	0	0				0.00		0			1.00		0
TOTAL		rate	amount	year			0	0	0	0	0	0	0	0	0	0

BUDGET #3 - POST-HARVEST ACTIVITY PROCESSING

B3. COMMODITY IN PROCESS	Unit	Price	Quant	TOTAL		TOTAL Market	TOTAL Social
raw cotton at ginnery gate	ton	0	1	0	1.00	0	0
					0.00		
TOTAL						0	0

BUDGET #3 - POST-HARVEST ACTIVITY PROCESSING

B3. REVENUES	Unit	Price	Quant	TOTAL	TOTAL Market	TOTAL Social
0	0	0	1	0	0	0
			0	0	0	0
				0	0	0
				0	0	0
TOTAL REVENUES					0	0

	L-NO (market)	L-O (market)	K (market)	TI (market)	TOTAL Market	L-NO (social)	L-O (social)	K (social)	TI (social)	TOTAL Social
TOTAL COST	0	0	0	0	0	0	0	0	0	0
PROFIT (BEFORE TAXES)					0					0

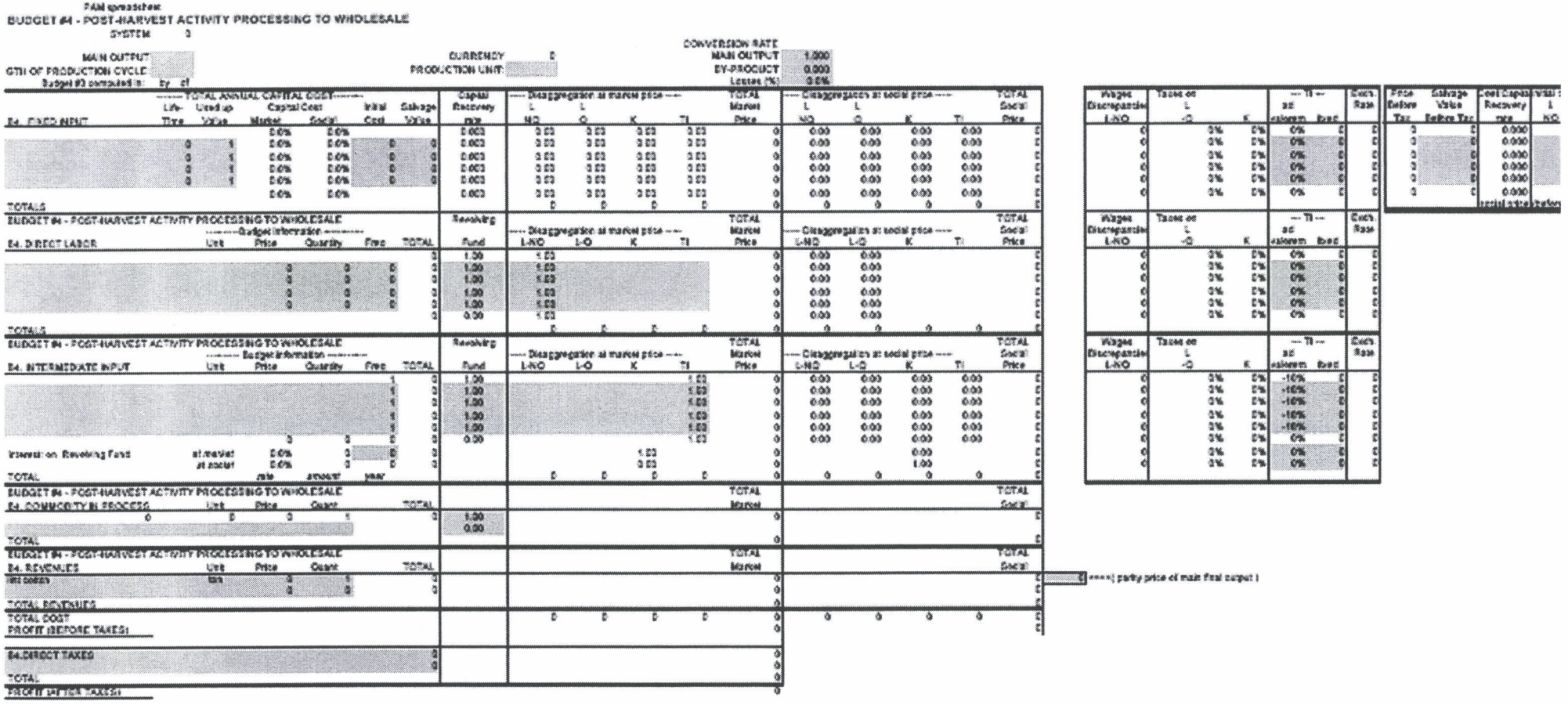
B3. DIRECT TAXES	TOTAL	TOTAL Market
	0	0
	0	0
TOTAL		0
PROFIT (AFTER TAXES)		0

Wages Discrepancies L-NO	Taxes on L-O	Taxes on K	TI ad valorem	TI fixed	Exch. Rate
0	0%	0%	0.0%	0	0
0	0%	0%	0.0%	0	0
0	0%	0%	0.0%	0	0
0	0%	0%	0.0%	0	0
0	0%	0%	0.0%	0	0
0	0%	0%	0.0%	0	0

Price Before Tax	Salvage Value Before Tax	Cost Capital Recovery rate	Value at L NO
0	0	0.000	
0	0	0.000	
0	0	0.000	
0	0	0.000	
0	0	0.000	
0	0	0.000	
		social price	before ...

Wages Discrepancies L-NO	Taxes on L-O	Taxes on K	TI ad valorem	TI fixed	Exch. Rate
0	0%	0%	0%	0	0
0	0%	0%	0%	0	0
0	0%	0%	0%	0	0
0	0%	0%	0%	0	0
0	0%	0%	0%	0	0
0	0%	0%	0%	0	0

Wages Discrepancies L-NO	Taxes on L-O	Taxes on K	TI ad valorem	TI fixed	Exch. Rate
0	0%	0%	0.0%	0	0
0	0%	0%	0.0%	0	0
0	0%	0%	0.0%	0	0
0	0%	0%	0.0%	0	0
0	0%	0%	0.0%	0	0
0	0%	0%	0.0%	0	0
0	0%	0%	0.0%	0	0
0	0%	0%	0.0%	0	0



Guideline for using a PAM spreadsheet template.

Assistance for Capacity Building Through Enhancing Operation of the National Agricultural Policy Centre
FAO Projects GCP/SYR/006/ITA and TCP/SYR/2906(A)

PAM spreadsheet

TABLE 1. BUDGET SUMMARY 0

1

UNIT: Thousands by

	---VALUES AT MARKET PRICE---						--- VALUE SOCIAL PRICE ---						---DIVERGENCES---					
	FARM	Budget #2	Budget #3	Budget #4	POST FARM	Repre. System	FARM	Budget #2	Budget #3	Budget #4	POST FARM	Repre. System	FERME	Budget #2	Budget #3	Budget #4	POST FARM	Repre. System
1.TOTAL REVENUES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Main final output	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
By-products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. TOTAL COST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A. Commodity in process		0	0	0	0			0	0	0	0			0	0	0	0	0
(tax+,subsidy-)	0	0	0	0	0	0												
B. Tradables	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C. Domestic Factors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unskilled Labor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Skilled Labor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PROFIT BEFORE-TAXES:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Direct taxes:	0	0	0	0	0	0												
PROFIT AFTER-TAXES:	0	0	0	0	0	0							(+=tax,-=subsidy)					

UNIT: by of

	---VALUES AT MARKET PRICE---						--- VALUE SOCIAL PRICE ---						---DIVERGENCES---					
	FARM	Budget #2	Budget #3	Budget #4	POST FARM	Repre. System	FARM	Budget #2	Budget #3	Budget #4	POST FARM	Repre. System	FERME	Budget #2	Budget #3	Budget #4	POST FARM	Repre. System
1.TOTAL REVENUES	14503	0	0	0	0	14530	0	0	0	0	0	0	14530	0	0	0	0	14500
Main final output	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
By-products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. TOTAL COST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A. Commodity in process		0	0	0	0			0	0	0	0			0	0	0	0	0
(tax+,subsidy-)	-14503			0	0	-14530												
B. Tradables	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C. Domestic Factors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unskilled Labor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Skilled Labor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capital	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PROFIT BEFORE-TAXES:	14503	0	0	0	0	14530	0	0	0	0	0	0	14530	0	0	0	0	14500
Direct taxes:	0	0	0	0	0	0												
PROFIT AFTER-TAXES:	0	0	0	0	0	14530							(positive=tax, negative=subsidy)					

Coefficient: Farm /Final Product:	0.000
Coefficient: Budget #2 /Final Product:	1.000
Coefficient: Post-processing /Final product:	1.000

PAM spreadsheet

TABLE 3A: POLICY ANALYSIS INDICATORS

1. FINANCIAL PROFITABILITY	[D = A - B - C]	14 500
2. FINANCIAL COST-BENEFIT RATIO	[C / (A - B)]	0.000
3. SOCIAL PROFITABILITY	[H = E - F - G]	0
4. DOMESTIC RESOURCE COST	[G / (E - F)]	#DIV/0!
5. SOCIAL COST-BENEFIT RATIO	[(F + G) / E]	#DIV/0!
6. TRANSFERS	[L = I + J + K]	14 500
7. NOMINAL PROTECTION COEFFICIENT (Including by-product)	[A / E]	#DIV/0!
7A. NOMINAL PROTECTION COEFFICIENT (Main final output only)	[A' / E']	#DIV/0!
8. EFFECTIVE PROTECTION COEFFICIENT	[(A - B) / (E - F)]	#DIV/0!
9. PROFITABILITY COEFFICIENT	[D / H]	#DIV/0!
10. PRODUCERS SUBSIDY RATIO	[L / E]	#DIV/0!
11. EQUIV. PRODUCER SUBSIDY	[L / A]	1.000

TABLE 3B: BREAK EVEN POINT

	At Market price	At Social price
	(% of current value)	
Yield	0.00 0.00	#DIV/0! #DIV/0!
FINAL OUTPUT PRICE	-14503.03 #DIV/0!	0 #DIV/0!
POST HARVEST COSTS	14503.03 #DIV/0!	0.00 #DIV/0!
DOMESTIC FACTORS COSTS	14503.03 #DIV/0!	0.00 #DIV/0!

TABLE 3A: POLICY ANALYSIS MATRIX

0 Version 0

UNIT: par

	REVENUES	COSTS: TRADABLES INPUTS	COSTS: DOMESTIC FACTORS	PROFITS
PRIVATE PRICES	A 0	B 0	C 0	D 0
SOCIAL PRICES	E 0	F 0 G	G 0	H 0
DIVERGENCES	I 0	J 0	K 0	L 0

TABLE 3A: POLICY ANALYSIS MATRIX

0

UNIT: by of Version 0

	REVENUES	COSTS: TRADABLES INPUTS	COSTS: DOMESTIC FACTORS	PROFITS
PRIVATE PRICES	A 14 500	B 0	C 0	D 14 500
SOCIAL PRICES	E 0	F 0	G 0	H 0
DIVERGENCES	I 14 500	J 0	K 0	L 14 500

Appendix B. Complementary and detailed explanations on PAM spreadsheet computations.

1. Estimation of fixed cost annual value.

1.1 Capital recovery rate:

Let A be the annual payment that will repay a Z amount in investment cost,

The value of the annual payments at the end of n years life-time will be:

$$\mathbf{A}\ (\ 1 + (1+i) + (1+i)^2 + \ldots + (1+i)^{n-1}\ ) = \mathbf{Z}$$

With $A(1+i)^{n-1}$ as the value of the first annuity at the end of the period of utilization of the investment; $A(1+i)^{n-2}$, the value of the second annuity.

The investment must generate a return equals at least to the interest rate. The total value of the invested capital to be amortized is:

$$\mathbf{Z}(\ 1+i)^n$$

The total value of the invested capital to be amortized is thus:

$$\mathbf{A}\ (\ 1 + (1+i) + (1+i)^2 + \ldots + (1+i)^{n-1}\ ) = \mathbf{Z}(\ 1+i)^n$$

Or :

$$A = Z\left[\frac{(1+i)^n i}{(1+i)^n - 1}\right]$$

with $\left[\frac{(1+i)^n i}{(1+i)^n - 1}\right]$ as the Capital recovery rate (Crr).

1.2. Capita recovery rate formula in the PAM spreadsheet:

Excel formula: D17/(1-1/(1+D17)^B17)
With D17 = interest rate and B17 = useful life

This formula is equivalent to the basic formula with the following rearrangement:

$$\frac{(1+i)^n i}{(1+i)^n - 1} = \frac{\frac{(1+i)^n i}{(1+i)^n}}{\frac{(1+i)^n - 1}{(1+i)^n}} = \frac{\frac{(1+i)^n i}{(1+i)^n}}{\frac{(1+i)^n}{(1+i)^n} - \frac{1}{(1+i)^n}} = \frac{i}{1 - \frac{1}{(1+i)^n}}$$

1.3. Computation of the annual value of the fixed cost

With:

Initial value of the fixed cost: Va
Residual (or salvage) value of the fixed cost: Vr
Useful life of the investment: n
Interest rate: i
Share of the investment used for the production of the main output. u

The annual value of the fixed cost is equal to:

$$FXa = \left(\frac{(1+i)^n i}{(1+i)^n - 1}\right) \times \left(Va - \frac{Vr}{(1+i)^n}\right) \times u$$

This corresponds to the application of the Capital Recovery Rate to initial costs after deduction of actualized salvage value of the investment, weighted by the share used for the production of the main output.

Example :

Investment Cost for a motor cultivator
Purchase Price : 8 000 000
Life-time : 5
Residual value : 800 000
Used up part : 1
Interest rate: 0.06

$$\text{Capital recovery factor} = \frac{(1+0.6)^5 \times 0.6}{(1+0.6)^5 - 1} = 0.237$$

$$\text{Actualized residual value} = \frac{800000}{(1+0.6)^5} = 597\,807$$

$$\text{Cost of durable capital} = 0.237 \times (800000 - 597807) \times 1 = 1\,757\,254$$

2. Breakdown of the cost of fixed inputs between tradable and domestic factors.

With:

Value to be depreciated:	Va
Residual value:	Vr
Interest rate:	i
Life-time:	n
Used up portion:	u
Custom duty ad valorem:	Tv
Fixed custom duty:	Tf
Durable Capital:	DC

And :

Fixed capital annual value:

$$FXa=\left(\frac{(1+i)^n i}{(1+i)^n-1}\right)\times\left(Va-\frac{Vr}{(1+i)^n}\right)\times u$$

Depreciation for one year.

$$DP=\frac{\left(\frac{Va-Tf}{(1+Tv)}-\frac{Vr}{(1+i)^n}\right)}{n}\times u$$

DP is the annual value of domestic factor and tradable that will be used in the production process during each year of investment useful life

Import tax

$$IT=\frac{Tf+\left(\frac{(Va-Tf)}{(1+Tv)}\times Tv\right)}{n}\times u$$

The duties on import are considered as a capital cost at private price, while they are deducted at social price.

Financial capital cost

FC = FXa- DP – IT

The financial cost, which is here the share of the fixed cost annual value corresponding to the opportunity cost of putting money in a given fixed cost is computed as a residual. In another form, the fixed cost annual value include, a depreciation component, duties and financial costs.

FXa= DP + IT + FC

Example:
Hand Tractor

Purchase Price : 8 000 000
Life-time: 5
Residual value: 800 000
Used up portion: 1
Interest rate: 0.06
ad valorem tax : 0.20
Fixed Taxe: 0

$$\text{Depreciation} = \frac{\frac{(8000000-0)}{(1+0.20)} - \frac{800000}{(1+0.06)^5}}{5} \times 1 = 1\,213\,772$$

$$\text{Import tax} = \frac{0 + \frac{8000000-0}{(1+0.20)} \times 0.20}{5} = 266\,667$$

Financial Capital Cost: 1 757 254 - 1 213 722 - 266667 = 276815

3. PAM spreadsheet formula for fixed cost computation.

3.1. Formula for the computation of coefficients of decomposition at market price for fixed costs inputs.

3.1.1. Coefficient of decomposition for non-qualified labor for fixed cost input at market price.

Excel formula: AD17/(B17*H17)
With AD17= share of non-qualified labor in cost item value
With B17 = useful life
With H17 = Capital Recovery Rate at market price.

Rationale: If "Va" the initial value of a fixed cost having , "Crr" being the recovery rate for an investment having a useful life of "n" years The total annualized value of the fixed cost will be: $Va \cdot Crr$; with $\frac{Va}{n}$ being the share of the annualized value corresponding the depreciation of the fixed cost. The difference $(Va \cdot Crr) - \left(\frac{Va}{n}\right)$ is the financial cost component of the fixed cost which is the opportunity cost of the investment and a part of the capital component of the fixed cost. Thus the share of the non-capital component of the investment is:

$$\frac{\frac{Va}{n}}{Va \cdot Crr} = \frac{\frac{Va \cdot n}{n}}{Va \cdot Crr \cdot n} = \frac{Va}{Va \cdot Crr \cdot n} = \frac{1}{Crr.n}$$

Thus, if the "l" is the share of labor included in the fixed input, the corresponding coefficient for the annualized value will be $l \cdot \frac{1}{Crr \cdot n}$

3.1.2. Coefficient of decomposition for qualified labor for fixed cost input at market price.

Excel formula: AE17/(B17*H17)
With AE17= share of qualified labor in cost item value
With B17 = useful life
With H17 = Capital Recovery Rate at market price.

Rationale: similar to the one for non-qualified labor component.

3.1.3. Coefficient of decomposition for capital for fixed cost input at market price.

Excel formula:
(1+(1/(B17*H17))*(AF17-1))+(AG17/(B17*H17)*(1-(1/(1+W17))*(F17-X17)/F17))

B17=useful life
H17=Capital Recovery Rate at market price
AF17= share in capital of the cost item
AG17=share of tradable input in the cost item
F17= value of the cost item at market price.
W17=ad valorem duty on tradable
X17=fixed duty on tradable

Rationale: The formula deducts from the unit the share of non capital component computed by the second term of the formula: (1/(B17*H17))*(AF17-1)). It, then, adds the share of the tradable component corresponding to the custom duties, because custom duties are capital costs and not a component of tradables. (AG17/(B17*H17)*(1-(1/(1+W17))*(F17-X17)/F17))

3.1.4. Coefficient of decomposition for tradable for fixed cost input at market price.

Excel formula: (AG17/(B17*H17))*(1/(1+W17))*(F17-X17)/F17))

AG17: share of tradable input the cost item
B17=useful life
H17=Capital Recovery Rate at market price
F17= value of the cost item at market price.
W17=ad valorem duty on tradable
X17=fixed duty on tradable

The Crr is applied on the value of the tradable: (AG17/(B17*H17)); without the share of the tradable component corresponding to custom duties, (1/(1+W17))*(F17-X17)/F17)), that are included in the coefficient of decomposition for the capital.

3.2. Formulas for the computation of coefficients of decomposition at social price

3.2.1. Coefficient of decomposition for non-qualified labor for fixed cost input at social price.

Excel formula: AD17/(B17*AC17)*T17
AD17= share of non-qualified labor in cost item value
B17 = useful life
AC17 = Capital Recovery Rate at social price
T17= coefficient of distortion between nominal or market wage level and social wage level

Rationale: Similar to one at market price but using the Crr computed with the social interest rate and applying the coefficient of distortion for wages.

3.2.2. Coefficient of decomposition for qualified labor for fixed cost input at social price.

Excel formula: AE17/(B17*AC17)/(1+U17)
AE17= share of qualified labor in cost item value
B17 = useful life
AC17 = Capital Recovery Rate at social price
U17= share of the employer contribution for insurance and other benefit attached to formal labor contract.

Rationale: similar to the computation for non-qualified labor.

3.2.3. Coefficient of decomposition for capital for fixed cost input at social price.

Excel formula: (1+(1/(B17*AC17))*(AF17-1))/(1+V17))
B17 = useful life
AC17 = Capital Recovery Rate at social price
AF17= share in capital of the cost item
V17= coefficient of distortion on the capital market.

Rationale: The formula deducts from the unit the share of non-capital cost, weighted by the prevailing distortion on the capital market.

3.2.4. Coefficient of decomposition for tradable for fixed cost input at social price.

Excel formula: AG17/(B17*AC17)*Y17
B17 = useful life
AC17 = Capital Recovery Rate at social price
AG17= share in tradable of the cost item
Y17= coefficient of distortion between the nominal exchange rate and the social exchange rate.

Rationale: The formula computes coefficient on the base of the share of tradable adjusted by the prevailing distortion on the currency market.

4. Break-down of cost items into domestic factors and tradable inputs component

Going further with the example of the hand tractor used in section 2 of this Appendix, the budget is completed with the inclusion of the variable cost related to the utilization of the equipment. Table A presents how the various budget items are combined to compute the coefficients indicating the labor, capital and tradable content of the input.

Example:
Hand tractor,

Fixed cost:

Purchase Price : 8 000 000
Life-time: 5
Residual value: 800 000
Used up portion: 1
Interest rate: 0.06
ad valorem tax : 0.20
Fixed Tax: 0

$$\text{Depreciation} = \frac{\frac{(8000000-0)}{(1+0.20)} - \frac{800000}{(1+0.06)^5}}{5} \times 1 = 1\,213\,772$$

$$\text{Import tax} = \frac{0 + \frac{8000000-0}{(1+0.20)} \times 0.20}{5} = 266\,667$$

Financial Capital Cost: 1 757 254 - 1 213 722 - 266667 = 276815

Variable Cost:

Labor: 400 000
Fuel and Oil: 2 800 000
Maintenance and miscellaneous: 700 000

Table A. Format for computing the decomposition coefficients of an input.

		Coefficient			Values		
		Labor	Capital	Tradable inputs	Labor	Capital	Tradable inputs
Fixed Cost							
Amortization	1 213 772			1.00	0	0	213 772
Import tax	266 667		1.00		0	266 667	0
Financial capital cost	276 815		1.00		0	276 815	0
Variable Cost							
Labor	400 000	1.00			400 000	0	0
Fuel and oil	2 800 000			1.00	0	0	2 800 000
Maintenance and miscellaneous	700 000	0.40	0.20	0.40	280 000	140 000	280 000
Total	5 657 254	0.12	0.12	0.76	680 000	683 482	4 293 772

5. The Cost of revolving fund for the case of variable costs

Length of cycle since operation (but not vegetative cycle): 6 months
Annual interest rate: 0.06

Operation	Amount (a)	Number of months elapsed between operation and harvest (b)	Coefficient revolving fund: = (b)/cycle (c)	Capital invested =(a) x (c) (d)
Seeding	28 000	5	0.83	23 333
Beginning/Weeding	112 000	4	0.67	74 667
Guarding	34 588	2	0.33	11 529
Harvesting	65 882	0	0.00	0
Treshing	19 765	0	0.00	0
Total				109 529

Cost of revolving fund = annual interest rate **x** (cycle /12 months) **x** Total of revolving fund

$$\text{Cost of revolving fund} = 0.06 \times \frac{6}{12} \times 109\,529 = 3\,286$$