PART THREE: EMPIRICAL MODEL, RESULTS AND CONCLUSIONS

CHAPTER VII - THE EMPIRICAL MULTI-COUNTRY-ESAM MODEL

7.1 Introduction

In this chapter the generic model developed in Chapter V is adjusted to fit the data available for this study. As mentioned earlier, biophysical data necessary for measuring impacts of transferring water from Lesotho to SA downstream the LHWP dams is only available for Lesotho. As a result, streamflow services' values only exist for the country of Lesotho. Also, From Chapter VI, data are available for regulating and supporting, and provisioning services of streamflows. Regulating and supporting services are measured by the value of resources supported by these services. These values only apply to resources accruing directly to households. There are no values of resources used as intermediate inputs in production. Therefore, for the empirical model, there is no need to adjust the VAD and business profits to reallocate benefits to ecological production.

In the same manner, IFR studies only calculated provisioning services of streamflows directly accruing to households. The studies did not measure the value of streamflows in cultivated agriculture or any form of economic production. Hence, necessary adjustments for the value of natural water in economic production are not made in this study. In summary, in the empirical model, the conventional multi-country SAM (MC-SAM) is adjusted with ecological resource values and services (i.e. regulating and supporting services of streamflows) directly accruing to households and values of water used by riparians for consumption and cultural purposes (provisioning and cultural services of streamflows). The Chapter is divided into three sections. The next section discusses data used in compiling the multi-country SAM for Lesotho and SA. Section 7.3 presents the macroeconomic MC-SAM and discusses how the microeconomic MC-SAM is disaggregated. Finally, the baseline microeconomic MC-ESAM for the two countries is presented in Section 7.4.

7.2 Data needs and Multi-country SAM (MC-SAM) for the study area

Compiling the MC-SAM required the following sources of data: (i) social accounting matrices of both Lesotho and South Africa, and, (ii) Macro-economic data on inter-country linkages. South African SAM for the year 2000 (Conningarth Consultants, 2000)[23] and the Lesotho SAM for the same year (Conningarth Consultants, 2002) were used to compile the MC-SAM. Supply and Use Tables (1999) from Statistics South Africa (Statssa) were used to derive proportions for some data in the South African SAM where necessary. For inter-country linkages, the RSA Reserve Bank and the Lesotho Central Banks' bulletins were used as well as other macroeconomic data published by the Bureau of Statistics in Lesotho and Statssa. Section 7.2.1 below discusses the compilation of the macroeconomic MC-SAM (MACROSAM), followed by the microeconomic MC-SAM (MICROSAM) in 7.2.2.

7.2.1 Multi-Country MACROSAM

When compiling a SAM it is important to commence with a macroeconomic SAM as it provides the main macroeconomic characteristics and magnitudes of the economies involved. The MACROSAM also sets the basic data framework for further development of the MICROSAM. It is highly aggregated and consists of control

[23] It is noteworthy to mention that the Depertment of Statistics South Africa (Statssa) recently published the 1998 RSA official SAM (25 November, 2002). However, this SAM cannot be used in this analysis because at the time the analysis commenced, the SAM was not yet published. However, both SAMs used the Statssa 1998 Supply and Use Tables and the Reserve Bank statistics as their data basis. Consequently, it is felt that there are not major differences between the two. The Conningarth's SAM has also been used before as an analytical tool for several government projects, e.g. Thukela project (Conningarth, 2000b). Additionally, the new Statsa SAM is based on the 1993 Integrated National Accounts system and the integrated accounts produced by the Reserve bank. These accounts are not yet accessible to the public. The Lesotho and Conningarth's RSA SAMs on the contrary are not based on the Integrated system of accounts. The two SAMs are therefore compatible. Because of

totals for major SAM accounts only, e.g. for each country it consists of only one activity, commodity, factor demand, value-added, factor payments, foreign trade, tax and savings characteristics, domestic demand and supply, and all domestic and international monetary transfers. As the first step of compiling the MC-ESAM, the multi-country MACROSAM was developed and it is a 22 x 22 matrix presented in Table 7.1 below. The cell descriptions of the matrix are given in Appendix.

all these reasons, it is justifiable to continue using the Conningarth's RSA SAM and not the new Stassa SAM.

TABLE 7.1: MACROSAM for Lesotho and South Africa for the year 2000 (in million Maloti)

				Lesotho								
						Current accounts					Capital account	
LESOTHO				Activities	Commodities	Factors		Institutions			Government	All other sectors
						Labour	Capital (GOS)	Enterprises	Households	Government		
				1	2	3	4	5	6	7	8	9
		Activities	1	-	7,817	-	-	-	-	-	-	-
		Commodities	2	5,591	-	-	-	-	4,736	1,288	489	1,990
Current accounts	Factors	Labour	3	2,180	-	-	-	-	-	867	-	-
		Capital	4	1,904	-	-	-	-	-	147	-	-
	Institutions	Enterprises	5	-	-	-	1,074	-	-	-	-	-
		Households	6	-	-	4,601	-	528	53	58	-	-
		Government	7	-81.9	1,532	-	367	184	304	82	-	-
Capital Accounts		Government	8	-	-	-	155	-	-	164	-	-
		All other sec	9	-	-	-	465	362	163	-	-	-
	RSA											
		Activities	10	-	4,508	-	-	-	-	-		
		Commodities	11	-	-	-	-	-	-	-		
Current accounts	Factors	Labour	12	-	-	163	-	-	-	3		
		Capital	13	-	-	-	195	-	-			
	Institutions	Enterprises	14	-	-	-	-	-	-	-	-	
		Households	15	-	-	-	-	-	1	-	-	
		Government	16	-	-	-	-	-	-	-	-	
Capital accounts		Government	17	-	-	-	-	-	-	-	-136	
		All other sec	18	-	-	-	-	-	-	-	-	-800
REST of WORLD		ROW										
		Factor payme	19	-	-	29	49	-	0	4	-	-
		Goods & serv	20	-	237	-	-	-	-	-	-	-
		Capital	21	-	-	-	-	-	-	-	-34	-200
		Residual	22	-	-	-	-	-	-	-	-	-
		Total	23	9,593	14,094	4,793	2,305	1,074	5,257	2,613	319	990

Table 7.1 continued

		South Africa															
	LESOTHO					Current accounts						Capital account		Rest of the world				
				Activities	Commodities	Factors		Institutions				Government	All other sectors	Factor payments&transf	Goods & services	Capital	Residual	Total
						Labour	Capital (GOS	Enterprises	Households	Government								
				10	11	12	13	14	15	16		17	18	19	20	21	22	23
		Activities	1	-	944	-	-	-	-	-		-	-	-	832	-	-	9,593
		Commodities	2	-	-	-	-	-	-	-		-	-	-	-	-	0	14,094
Current	Factors	Labour	3	-	-	1,746	-	-	-	-		-	-	-	-	-	-	4,793
accounts		Capital	4	-	-	-	203	-	-	-		-	-	51	-	-	-	2,305
	Institutions	Enterprises	5	-	-	-	-	-	-	-		-	-	-	-	-	-	1,074
		Households	6	-	-	-	-	-	14	-		-	-	3	-	-	-	5,257
		Government	7	-	-	-	-	-	-	181		-	-	45	-	-	0	2,613
Capital		Government	8	-	-	-	-	-	-	-		-	-	-	-	-	-	319
Accounts		All other se	9	-	-	-	-	-	-	-		-	-	-	-	-	-	990
	RSA																	-
		Activities	10	-	1,112,105	-	-	-	-	-		-	-	-	249,296	-	-	1,365,909
		Commodities	11	687,341	-	-	-	-	555,818	45,215		19,071	116,520	-	-	-	-4,187	1,419,778
Current	Factors	Labour	12	308,288	-	-	-	-	-	115,425		-	-	348	-	-		424,227
accounts		Capital	13	356,624	-	-	-	-	-	-		-	-	14,418	-	-		371,237
	Institutions	Enterprises	14	-	-	-	219,031	-	-	51,337		-	-			-		270,368
		Households	15	-	-	422,018	-	208,501	10,603	26,922		-	-	259		-	0	668,304
		Government	16	13,656	79,644	-	8,439	28,397	99,369	7,176		-	-	479		-	0	237,160
Capital		Government	17	-	-	-	16,790	-	-	-15,868		-	-			136		922
accounts		All other se	18	-	-	-	95,843	33,390	2,386	-		-	-			1,736		132,555
	REST of WORL	ROW																-
		Factor paym	19	-	-	460	35,229	80	114	6,775				-	-	-	-	42,740
		Goods & ser	20	-	226,974									-	-	-	-	227,211
		Capital	21	-								-18,149	16,035	-	-	-2,816	-	-5,164
		Residual	22	-		3	-4,298			-3				-	-	-	-	-4,298
		Total	23	1,365,909	1,419,667	424,227	371,237	270,368	668,304	237,160		922	132,555	15,603	250,128	-944	-4,187	

The MACROSAM was derived from Lesotho and RSA year 2000 SAMs. The process involved simple aggregations of accounts except in the case of economic flows between the two countries. It was difficult to get data on these flows, especially trade flows, from the South African side because of the nature of trade agreement between the two countries. Lesotho and South Africa are members of the Southern African Customs Union (SACU) together with Botswana, Swaziland and Namibia. South Africa does not treat these respective countries individually in its statistics (pers. comm. with South African Revenue Services (SARS) officials, November, 2002), rather it lumps them together as SACU countries. In the case of financial flows, RSA residents do not consume financial services in Lesotho except for RSA citizens residing in Lesotho. On the contrary, Lesotho residents always cross borders to buy financial services in South Africa. As a result, data on flows between the two countries mainly came from the Lesotho side. The Lesotho SAM provided the basis for the split between the rest of the world (ROW) and RSA. This information was used to split the ROW accounts in the RSA SAM into Lesotho and the ROW.

7.2.2 Multi-country MICROSAM

After the MACROSAM, the next step is the construction of the MICROSAM, and MACROSAM control totals help with ensuring consistency in the MICROSAM. Like the MACROSAM, the MICROSAM was derived from the SA and Lesotho year 2000 SAMs. The construction of the MICROSAM was a lot tedious compared to the MACROSAM since most of account classifications (e.g. households) were different in the Lesotho and RSA SAMs. Consequently, they had to be normalised to induce uniformity in the multi-country SAM. In some cases, the disaggregations in both SAMs were not in the format conducive for the multi-country SAM and had to be adjusted.

The most tricky and challenging aspect of the multi-country MICROSAM was deriving inter-country flows. This section describes the disaggregation of the

MICROSAM, data sources and data adjustments carried out. Because of adequate data, the MICROSAM was populated and balanced manually, although in some cases assumptions had to be made to derive appropriate data distributions.

7.2.3 Disaggregation of the MICROSAM into MC-SAM

The major objective of this analysis is to measure economic and ecological benefits/costs of the LHWP through a multi-country ESAM analysis. The rationale for using the multi-county approach is to determine if there are spill-over benefits/costs due to welfare impacts resulting from loss of ecological resources (resulting from modified stream flows below the LHWP dams in Lesotho, between Lesotho and SA) and policy implications of such spill-overs. The disaggregation of the MICROSAM was therefore motivated by this focus.

The production accounts are disaggregated into ten production sectors which include activity and corresponding commodity accounts that define major production sectors of a country according to the System of National Accounts. The SAM distinguished four production factors in each country: skilled, semi-skilled and unskilled labor and capital. Because of the significance of welfare implications of ecological resources in Lesotho, Lesotho households were disaggregated into 4 categories: (i) Mountain households high-income, (ii) Mountain households low-income, (iii) Other households high-income, and (iv) Other households low-income households. The ecological impacts of the LHWP are likely to be mostly felt by the rural mountains populations residing within the reaches of the rivers downstream the LHWP dams in Lesotho. Hence, an ideal households classification, that would better address the objectives of this study, would be the 10 categories according to geographic and income distribution found in the Lesotho year 2000 SAM (see Table 7.2 below).

TABLE 7.2: Lesotho Households Classification

Household No.	Description

1	Urban high-income
2	Urban low-income
3	Lowlands high-income
4	Lowlands low-income
5	Foothills high-income
6	Foothills low-income
7	Senqu River Valley (SRV) high-income
8	SRV low-income
9	Highlands high-income
10	Highlands low-income

These classifications were also used in the 1995 (the most recent) household budget survey for Lesotho (BOS, 1995). However, the classifications are only unique to Lesotho and for uniformity, the above four mentioned classifications, which also conform to RSA data were used in the MC-SAM.

The government, capital and rest of the world accounts were aggregated in the MC-SAM. Important areas of impact that the MC-SAM is intended for is on households welfare and general economic output of the two countries. In Lesotho it is important to know to what extent households are affected by loss of ecological resources and to what extent this impact is translated into the rest of the economy and SA economy, with specific focus on output of different economic sectors and effect on employment generated by these sectors. In SA, it is important to know, to what extent different economic sectors in SA will be affected if SA were to internalise ecological losses in Lesotho, and how this would affect the rest of SA and Lesotho economies, with emphasis on impact on economic output, employment generation and households welfare in the two countries. Table 7.3 below lists the accounts of the MC-SAM. The MC-SAM has 61 accounts, 56 endogenous and 5 exogenous. Details on the SAM compilation and the populated SAM are reported in Appendix F (see Table F8 in

Appendix F).

TABLE 7.3: MICROSAM accounts

Acc. No.	LESOTHO Description	Acc. No.	SOUTH AFRICA Desription
	ENDOGENOUS ACCOUNTS		
	A. Production		**A. Production**
1	Agriculture	32	Agriculture
2	Mining and quarrying	33	Mining and quarrying
3	Manufacturing	34	Manufacturing
4	Electricity	35	Electricity
5	Water	36	Water
6	Construction	37	Construction
7	Trade and accommodation	38	Trade and accommodation
8	Transport and communication	39	Transport and communication
9	Financial and business services	40	Financial and business services
10	Community services	41	Community services
	B. Factors		**B. Factors**
21	Skilled labor	52	Skilled labor
22	Semi-skilled labor	53	Semi-skilled labor
23	Unskilled labor	54	Unskilled labor
24	Capital (GOS)	55	Capital (GOS)
	C. Institutions		**C. Institutions**
25	Enterprises	56	Enterprises
26	Urban-High income households	57	High income households
27	Urban-Low income households	58	Low income households
28	Rural-High income households		
29	Rural-Low income households		
	EXOGENOUS ACCOUNTS		
30	**D. Government**	**59**	**D. Government**
31	**Combined capital**	**60**	**Combined capital**
		61	**The Rest of the World**

7.3 The Multi-country ESAM

As explained at the beginning of this chapter, data required to measure streamflow resources and services' values only exist for Lesotho. Therefore, to develop the

ESAM, only the Lesotho SAM in the MC-SAM was adjusted with streamflow services values. Monetary values derived for streamflow services and resources in Chapter VII indicate that ecological production contributed approximately M46.43 million to Lesotho's GDP in the year 2000. This means that the Lesotho GDP for 2000 was underestimated by this amount in the country's system of national accounts. This money directly accrued to rural mountain households living within the reaches of the rivers downstream the LHWP dams in Lesotho in terms of streamflow resources and services they directly use to sustain their livelihoods.

Therefore, the following adjustments were made to the Lesotho SAM:

(i) The SAM was extended with two external accounts, ecological production and natural water, to account for contribution of the two activities to the economy of Lesotho, which is M46.16 and M0.24 million, respectively. These values represent C_N and C_Q, respectively, from Chapter IV.

(ii) These values were distributed to appropriate institutions, i.e. rural households, under the assumption that high- and low-income rural households use 20% and 80%, respectively, of the total value of streamflow resources and services' value. This assumption is based on personal discussions with officials at the Bureau of Statistics (BOS) in Lesotho. Thus, in the case of ecological production, M9.24 and M36.95 million were allocated to high- and low-income mountain households, respectively. For natural water M0.05 and M0.19 million were allocated to high- and low-income mountain households, respectively.

(iii) High- and low-income mountain households spent the money received from ecological production and natural water on ecological resources and services and on natural water and services consumed according to proportions assumed in (ii) (i.e. M9. 24 and M36.95.01 million, respectively, for ecological resources and M0.05 and M0.19 million, respectively).

The MC-ESAM has 63 accounts comprising of 56 endogenous and 7 exogenous accounts and is reported in Appendix G. The MC-ESAM is used to perform the analysis in the next Chapter.

CHAPTER VIII - RESULTS OF THE EMPIRICAL ANALYSIS AND POLICY SIMULATIONS

8.1 Introduction

This chapter presents the LHWP impact results derived from the MC-ESAM. As outlined in Chapter II, the project commenced in 1986 and the water royalties and hydropower benefits started flowing in 1998. These benefits, and other indirect benefits associated with the project outlined in Chapter II, were already included in the Lesotho and SA SAMs for the year 2000 that were used in compiling the MC-ESAM. As such, direct and indirect economic benefits of the LHWP are already included in the MC-ESAM. Therefore, the LHWP impact results presented in this chapter only relates to ecological impact of the project. Also, the project impact analysis could not be compared between the with- and without-project scenarios because, as mentioned before, the SAMs used in this study already included some of the project effects. The next section discusses the multiplier matrix derived from the MC-ESAM. The results of the impact of the LHWP on the economies of Lesotho and SA, due to lost ecological services of the highlands rivers downstream the LHWP dams in Lesotho are presented in Section 8.3. Lastly, different policy scenarios that can be used to mitigate/compensate ecological losses resulting from the LHWP are discussed in Section 8.4.

8.2 MC-ESAM Multiplier Analysis

The MC-ESAM was used to examine intersectoral linkages within (intra-country) and between (inter-country) Lesotho and SA in terms of the multipliers generated from external shocks into each of the endogenous elements of the MC-ESAM. Detailed derivation and discussions of the intra-country (M_1) and inter-country (M_2) multiplier matrices are found in Appendices A and C. Table 8.1 presents a summary of intra-

country multipliers from selected MC-ESAM accounts. In Table 8.2, a summary of inter-country multipliers is presented. The complete multiplier matrix for the MC-ESAM is given in Appendix H.

TABLE 8.1: Summary table of MC-ESAM Intra-country multipliers on selected accounts (Maloti)

INTRA-COUNTRY MULTIPLIERS										
	LESOTHO					SOUTH AFRICA				
	Total production multipliers (1)	Own-sector multipliers (direct) (2)	With other sectors (indirect) (3)	Induced employ-ment (4)	Induced house-holds income (5)	Total production multipliers (1)	Own-sector multipliers (direct) (2)	With other sectors (indirect) (3)	Induced employ-ment (4)	Induced house-holds income (5)
Agriculture	3.03	2.03	1.12	0.52	0.80	4.83	1.90	2.93	0.48	0.84
Mining and quarrying	1.46	1.14	0.35	0.13	0.19	4.44	1.23	3.21	0.60	0.92
Manufacturing	1.90	1.50	0.47	0.14	0.21	4.15	2.40	1.76	0.41	0.63
Electricity	4.14	2.29	1.95	0.48	0.81	5.07	2.05	3.02	0.57	1.00
Water	2.20	1.49	0.78	0.29	0.69	6.32	3.28	3.04	0.47	0.91
Construction	4.38	2.59	1.91	0.35	0.55	6.04	2.31	3.72	0.62	0.92
Trade and accommodation	3.50	1.83	1.79	0.51	0.79	5.44	2.41	3.03	0.65	1.03
Transport and communication	3.04	1.74	1.40	0.38	0.58	5.40	2.34	3.06	0.64	1.01
Real estate, business and financial services	2.60	1.86	0.83	0.35	0.64	5.19	2.92	2.27	0.55	0.97
Government, domestic and other community services	1.81	1.92	1.81	0.36	0.52	5.62	1.95	3.68	0.88	1.18

Starting with intra-country multipliers in Table 8.1, for each country column 1 shows total production multipliers of each production sector. Column 2 shows direct multipliers. It shows the effect of external injection on total output/income of the endogenous account involved. Using the agriculture sector as an example, direct

multipliers show the impact of a unit (say M1.00) injection in the sector on its total output. In the case of Lesotho, M1.00 injection in the agricultural sector increases the sector's total output by M2.03 on average. Direct multipliers are also called 'open-loop' multipliers. Column 3 shows indirect/induced multipliers. These multipliers show transmission of income from initial endogenous account (in this case production activity) to factors, institutions and then back to initial account in the form of consumption demand (Sadoulet and de Janvry, 1995). These multipliers are often called 'closed-loop', which is the algebraic statement of the circular flow of income (Pyatt and Round, 1985). Columns 4 an 5 show employment and household incomes generated by external injections in the endogenous accounts.

In Lesotho the sector with the highest total production multiplier is construction (M4.38), followed by electricity (M4.14). This is not surprising because construction activities associated with the LHWP were still going on in the year 2000 and water transfer to SA and hydropower generation had just begun in 1998. The construction sector also has the highest own multiplier. For this sector, every M1.00 injected into the sector generates total income of M2.59 on average for the sector. Despite the fact that the sector has the highest total and own-sector production multipliers, it is not the best sector in terms of employment and household income generation. The best sector in this regard is agriculture.

In the case of SA, the water sector has the highest total production multiplier and the highest own-sector production multiplier. However, it is the government sector that has the highest potential for employment and income generation. For every R1.00 injected in this sector, R0.88 worth of employment is created and R1.18 income is generated for households. Although the results discussed above are important for understanding the economies of the countries studied here, they do not include income linkages between Lesotho and SA. Table 8.2 below shows such linkages. The multipliers presented in Table 8.2 show effects of exogenous change in one country (e.g. Lesotho) on the incomes of endogenous accounts of the other country (e.g. SA).

TABLE 8.2: Summary table of MC-ESAM Inter-country multipliers on selected accounts (Maloti)

	INTER-COUNTRY MULTIPLIERS									
	LESOTHO, SA					SA, LESOTHO				
	Total production multipliers (1)	Own-sector multipliers (direct) (2)	With other sectors (indirect) (3)	Induced employ-ment (4)	Induced house-holds income (5)	Total production multipliers (6)	Own-sector multipliers (direct) (7)	With other sectors (indirect) (8)	Induced employ-ment (9)	Induced house-holds income (10)
Agriculture	0.010	0.002	0.008	0.004	0.004	2.20	0.37	1.83	0.24	0.09
Mining and quarrying	0.010	0.000	0.011	0.004	0.005	3.08	0.76	2.32	0.41	0.14
Manufacturing	0.008	0.004	0.005	0.003	0.003	2.80	1.54	1.26	0.28	0.09
Electricity	0.010	0.000	0.010	0.004	0.004	1.84	0.04	1.80	0.21	0.07
Water	0.053	0.031	0.010	0.009	0.012	0.88	1.54	0.87	0.10	0.04
Construction	0.010	0.000	0.011	0.004	0.005	2.37	0.01	2.36	0.25	0.09
Trade and accommodation	0.014	0.004	0.011	0.004	0.005	1.93	0.20	1.73	0.22	0.08
Transport and communication	0.012	0.002	0.011	0.005	0.005	2.49	0.53	1.96	0.28	0.10
Real estate, business and financial services	0.007	0.001	0.007	0.003	0.003	2.28	0.90	1.38	0.25	0.09
Government, domestic and other community services	0.010	0.001	0.010	0.004	0.004	2.48	0.28	2.20	0.30	0.09

Columns 1 and 6 of the table show total production multipliers for Lesotho production sectors generated by external production shocks in SA, and vice versa. Columns 2 and 7 show own-sector/direct multipliers for each country and consist of income effects transmitted from an endogenous account in one country to an endogenous account in another. These are also referred to as open-loop multipliers. Columns 3 and 8 show income effects transmitted from an endogenous account in one country through the corresponding account in the other country to other accounts in that country and to the originating country, due to induced effects, i.e. complete round of

effects between the two countries. These are also called closed-loop or circular multipliers. Lastly, columns 4 and 9, and 5 and 10, show employment and household income, respectively, generated in one country due to external production shocks in onothe country.

The multipliers in columns (Lesotho, South Africa) are uniformly and generally low compared to those under columns (South Africa, Lesotho). As Reinert and Roland-Holst (1998) put it, this reflects the 'hub-and-spoke' nature of both economies. Exogenous expenditures in Lesotho have large impacts on SA as can be seen in the columns (South Africa, Lesotho). This reflects the dependence of the Lesotho economy on SA imports. On the contrary, SA has a more diversified import structure compared to Lesotho. Consequently, exogenous expenditures in SA have small impacts on Lesotho. From Table 8.3, the manufacturing sector in the columns (SA, Lesotho) has the highest production multiplier. This means that for every M1.00 increase in demand for manufactured products in Lesotho, total output of the manufacturing sector in SA increases by R1.54 on average. Due to effects induced by this increase, other sectors output increase by R1.26 and total growth impact induced by the manufacturing sector in SA is R2.80. Also, From the households intra- and inter-country multipliers in Table 8.3 below, Lesotho households have strong multipliers with the manufacturing sectors of Lesotho and SA. Table 8.3 presents multipliers that show linkages between Lesotho households income and that of production sectors in Lesotho and SA. The columns (Lesotho, Lesotho) show inter-linkages within Lesotho while the columns (SA, Lesotho) show linkages from Lesotho households to SA production sectors.

Considering the Mountain households, who will be directly affected by the LHWP, for every increase of M1.00 in the high-income Mountain households' income, the manufacturing sector of Lesotho grows by M1.07 and that of SA by 1.189 on average. In the case of low income households, M1.00 increase in their income leads to M0.79 increase in total output of the Lesotho Manufacturing sector and R0.91 increase in

total output of the SA manufacturing sector on average.

TABLE 8.3: Direct multipliers between households and production sectors (Maloti)

	Lesotho, Lesotho				South Africa, Lesotho			
	Mountains - High income	Mountains - Low income	Other - High income	Other - Low income	Mountains - High income	Mountains - Low income	Other - High income	Other - Low income
Production								
Agriculture	0.581	0.288	0.471	0.380	0.170	0.108	0.151	0.141
Mining and quarrying	0.004	0.003	0.004	0.005	0.037	0.028	0.036	0.037
Manufacturing	1.070	0.794	1.039	1.037	1.189	0.907	1.144	1.173
Electricity	0.025	0.020	0.041	0.038	0.044	0.035	0.042	0.044
Water	0.012	0.012	0.030	0.023	0.014	0.011	0.013	0.014
Construction	0.022	0.018	0.025	0.031	0.012	0.010	0.011	0.012
Trade and accommodation	0.250	0.109	0.270	0.206	0.243	0.194	0.233	0.249
Transport and communication	0.064	0.055	0.076	0.106	0.187	0.148	0.180	0.196
Real estate, business and financial services	0.225	0.353	0.152	0.230	0.377	0.359	0.340	0.387
Government, domestic and other community services	0.114	0.241	0.221	0.549	0.109	0.101	0.115	0.152

Although the manufacturing sector has the highest own-sector multiplier in Table 8.2, the mining sector has the highest total multiplier (R3.08). For every M1.00 increase in demand for mining products in Lesotho, the SA mining sector grows by R0.76 on average. But because of strong backward and forward linkages that this sector has with the rest of production sectors in SA, total growth in other sectors is R2.32 on average (see Table 8.2). Dependence of Lesotho economy on that of SA is also seen from employment and household income generation in SA induced by external shocks

in Lesotho. A M1.00 increase in demand for products from each of Lesotho production sectors yields approximately R0.25 worth of employment on average for SA labor and generates approximately R0.45 income for SA households (see columns 9 and 10 of Table 8.2).

Skilled and un-skilled SA labor benefit more than semi-skilled labor from employment generated by demand increase in Lesotho and high-income households benefit more than low-income households from the income generated (see Appendix H). On the contrary, external demand increase in SA has very insignificant impact on Lesotho labor employment and on households' income generation (see columns 4 and 5 of Table 8.2). Because of the 'Hub and spoke' nature of the two economies, ignoring ecological losses to Lesotho households resulting from the LHWP will not only hamper the economy of Lesotho, but also that of SA. The next section presents results derived from analyzing the impact of lost ecological services on the economies of Lesotho and SA.

8.3. Impact of lost ecological services on the economies of Lesotho and SA

To analyse the impact of the LHWP (on the capacity of the project rivers' to provide different ecosystem services) on the economies of SA and Lesotho, The value of the lost services was introduced in the MC-ESAM as an external reduction in Mountain households income. It should be noted that this income fall does not emanate from the general project. The project has significant direct economic benefits bound to increase incomes of both the economy of Lesotho and SA. The income loss referred to here is that resulting from lost ecological services. As such, all income effects that follow only refer to ecological losses as a result of the project and not the general project.

The results of the impact analysis are reported in Table 8.4 below. The loss of ecological services (as seen in Chapter VII) represents 0.74% and 4.66 % fall in high- and low-income Mountains households, respectively. But due to multiplier effects, the fall represents 0.81% and 4.81% fall in income for high- and low-income Mountain households, respectively (see Table 8.4).

Because of the inter- and intra-linkages that exist between Lesotho and SA (see the multipliers matrix in Appendix H), the loss of ecological services does not only affect households directly affected by the LHWP, i.e., the Mountains households, but also other households in Lesotho and SA, though the percentage loss is low. Other high-income and low-income households of Lesotho are likely to loose income of M1.89 and M0.20 million on average, respectively. In SA high- and low-income households are likely to loose income of M2.38 and M0.65 million, respectively. In addition, because of direct and induced multipliers, the loss in ecological services is also likely to affect economic production in both Lesotho and SA.

In both countries production sectors likely to suffer most are manufacturing sectors with income loss of M7.63 and M8.66 million, respectively. However, in terms of proportion to total income of respective sectors, the losses are very insignificant (0.08% and 0.0008%, respectively). The fact that the manufacturing sector is likely to be the worst hit by the impact of lost ecological values, and that the SA manufacturing sector is likely to loose most money is not surprising given the strong multipliers that Mountain households have with manufacturing sectors of the two countries, and strong forward multipliers that the SA manufacturing sector has with that of Lesotho (see Appendix H).

TABLE 8.4: Impact of lost ecological services in Lesotho due to the LHWP (2000 million Rands)

	Total income in Lesotho	Total income in SA	Change in Lesotho Income	% Change	Change in SA Income	% Change
Agriculture	2687.51	94302.5	-3.11	-0.12	-1.08	-0.0011
Mining	47.4007	115668	-0.03	-0.07	-0.27	-0.0002
Manufacturing	9397.77	1047034	-7.63	-0.08	-8.66	-0.0008
Electricity	435.636	57711.5	-0.19	-0.04	-0.33	-0.0006
Water	370.289	17621.6	-0.11	-0.03	-0.10	-0.0006
Construction	5019.6	148571	-0.17	-0.00	-0.10	-0.0001
Trade	1889.19	361783	-1.23	-0.07	-1.83	-0.0005
Transport	763.269	275261	-0.51	-0.07	-1.40	-0.0005
Business	1518.67	503838	-2.94	-0.19	-3.26	-0.0006
Community services	1557.63	163895	-1.93	-0.12	-0.92	-0.0006
FACTORS						
Skilled labor	1348.69	189838	-0.55	-0.04	-0.77	-0.0004
Semi-skilled labor	1389.2	90238.8	-0.58	-0.04	-0.37	-0.0004
Unskilled labor	2055.11	144150	-0.75	-0.04	-0.77	-0.0005
Capital	2304.98	371237	-1.71	-0.07	-2.37	-0.0006
INSTITUTIONS						
Enterprises	1073.98	270368	-0.80	-0.07	-1.40	-0.0005
Mountain households high-income	240.19	-	-1.92	-0.80	-	-
Mountain households low-income	154.44	-	-7.43	-4.81	-	-
Other households high-income	4,362.69	-	-1.89	-0.04	-	-
Other households low-income	545.94	-	-0.20	-0.04	-	-
SA high income	-	513684	-	-	-2.38	-0.0005
SA low-income	-	154620	-	-	-0.65	-0.0004
Total	**37162.18**	**4519821.40**	**-33.71**	**-0.09**	**-26.66**	**-0.0006**

Again, due to induced multipliers, Lesotho and SA factors are likely to loose

employment, with SA factors loosing by higher magnitudes compared to those of Lesotho because of strong forward multipliers that SA has with Lesotho (see Appendix H). For example, the impact of lost ecological values is likely to lead to total fall in employment of M1.88 and M1.91 million for Lesotho and SA, respectively, with unskilled labor likely to be the hardest hit in both countries (see Table 8.4). In the case of capital, both counties are likely to loose M1.71 and M2.37 million for Lesotho and SA, respectively.

The total impact is likely to be -M33.79 million (at 2000 prices) for the economy of Lesotho, which is equivalent to only 0.09% of total national income. In SA the total impact is likely to be -M26.66 million, which is highly insignificant compared to SA national income (0.0006%). It is not surprising that the percentage changes are this small because of the size of the impact compared to the sizes of both Lesotho and SA economies. Notwithstanding, the important result remains that, if unaccounted for and mitigated against or compensated, ecological losses due to water transfer projects can have significant negative impacts on riparians and to some extend, the general economies of involved countries.

The total impact of instream losses in Lesotho is notably small compared to the LHWP water rent or royalties of approximately US$45 millions annually payable to the government of Lesotho by SA. This therefore shows that the LHWP is highly beneficial to the people of Lesotho and that the instream losses can simply be offset through compensation or mitigation measures to ensure sustainable livelihoods of households involved. Since SA is the ultimate beneficiary of the LHWP, it should compensate for the instream losses. The next section therefore simulates different policy scenarios to analyse how the compensation money, if paid, can be used to increase the welfare of riparians.

8.4 Policy simulations

The results in Table 8.4 clearly show that the loss of ecological services in Lesotho due to the LHWP will affect the welfare of households directly affected by the project in Lesotho, and that due to direct (open-loop) and indirect/induced (closed-loop) multiplier effects, other households in Lesotho and SA, as well as entire economies of the two countries will also be affected, though at insignificant rates. The ecological services losses assessed in this study were never included in the EIA of the LHWP. Therefore, evidently the LHWP has an un-anticipated externality amounting to M8.99 million, which is absorbed by sectors directly benefiting from water from the LHWP at a cost to households directly affected by ecological services loss in Lesotho. For the project to achieve Pareto improvement required for sustainable development, the ecological losses identified in this study need to be internalized, either through mitigation activities or direct compensation by the country and sectors absorbing the externality as profits or benefits.

The water from the LHWP is planned for ultimate use in SA for industrial and residential expansion, though it is used for hydropower generation in Lesotho before it leaves it's boarders. As a result, this study assumes that the externality of ecological services loss is absorbed by SA and thus has to be internalized by activities in SA that benefit from such water. The externality was divided among all the water-using sectors in SA. To distribute the cost between these sectors the proportions of water supplied to the sectors by SA water authorities were used. Table 8.5 below gives a list of such activities (column 1), total water supplied to them (column 2), percentage of supply to total water available (column 3), total income of each activity as calculated in the MC-ESAM (column 4) and amount required from each activity to internalize the externality (column 5). This was calculated by using percentages in column 3 to split R9 million between all the water using activities. For example, in the case of agriculture, the amount required to intenalise the externality is 76.9% of R9 million, which equals R6.92 million, representing only 0.007% of total

agricultural income.

TABLE 8.5: Quantity of water supplied to different users in SA by water authorities[24] and amount required to internalize the externality from each sector

Production Use	Total water supply (million m^3)	% supply	Total income in millions of Rands (at 2000 prices)	Amount required to internalise externality (millions of Rands at 2000 prices)	as a % of total income
(1)	(2)	(3)	(4)	(5)	(6)
Agriculture	10322	76.9	94302.49	6.92	0.00734
Mining	237	1.77	115668.43	0.16	0.00014
Electricity	216	1.61	1047034.24	0.12	0.00001
Manufacturing	185	1.38	57711.45	0.14	0.00025
Construction	34	0.25	148570.96	0.02	0.00002
Trade	145	1.08	361783.45	0.10	0.00003
Transport	105	0.78	275260.68	0.07	0.00003
Business services	186	1.39	503837.79	0.12	0.00002
Government	197	1.47	163895.26	0.13	0.00008
Social Use					
High income households	1249	9.3	513684.0746	0.84	0.00016
Low income households	547	4.08	154619.9475	-0.37	-0.00024
Total	**13423**	**100**	**3436368.78**	**-9.00**	**-0.00026**

Source for water supply figures: Adapted from Crafford et al. (2001).

Three policy scenarios for internalizing the externality were considered:

(i) Money paid by SA to internalize ecological services loss is transferred to households directly affected by the project in Lesotho.

(ii) Money paid by SA to internalize ecological services loss used to finance agricultural programs in Lesotho.

(iii) 70 % of the money paid by SA to internalize ecological services loss used to finance agricultural programs and 30% transferred to affected households in Lesotho.

The first scenario analyses the impact of pure cash transfer to compensate Mountain households for lost ecological services. However, since cash transfers cannot be

[24] The water supply authorities consist of the Department of Water Affairs and Forestry/Catchment Management Areas (DWAF/CMA), irrigation boards, water boards, District Councils and Local Authorities.

administered annually and thus are not sustainable in the long-term, other scenarios that promise benefits to current and future households were considered. Scenario 2 analyses the impact of using the money paid to internalise ecological costs to support agricultural programs that can possibly mitigate against loss of resources like firewood, vegetables and fish. The third scenario analyses the impact of using some of the money to compensate affected households (cash transfer), and the rest to support agricultural programs. Table 8.6 reports the results of the three policy simulations.

It should be noted that these are mere policy scenarios used to show the results of spending compensation money, if given, in three different ways. To assess the benefit of increased expenditure on agricultural related products, the measures of gross domestic product (GDP) for the general economies of Lesotho and SA, and income that will finally accrue to households are used as proxies to measure welfare impacts of increased demand/expenditure on agricultural products and induced demand on products that have forward and backward linkages with the agricultural sector. Spending on agriculture and benefits thereof is effected through consumers' demand. It would be more appropriate to assess benefits of increased spending on agriculture through the welfare function or a comparative type of analysis such as those using returns from investment in Research and development (R&D). However, the analysis employed in this study cannot allow this type of assessment. Also, since the analysis of benefits from increased expenditure on agriculture is not the main focus of this study, it is appropriate to use GDP and household incomes as proxies for welfare measurement.

From Table 8.6 Scenario 1 is the most effective in restoring affected households welfare. Mountain high- and low-income households' income increased by exactly the same magnitude by which it initially fell and so does the income of the rest of the households in Lesotho and the Lesotho economy in general. The impact of this

scenario on SA economy is highly insignificant (-0.001%), which is not surprising given the size of the economy relative to the size of the externality. It is only the agricultural sector whose income falls by a relatively bigger magnitude (-0.013%) compared to other sectors (0.001%) because the sector is highly water intensive.

In the case of Lesotho Scenarios 2 and 3 are the most effective in increasing national economic growth with both scenarios promising 0.12% and 0.10% growth on average, respectively. However, the scenarios are not strong in restoring affected households welfare. In scenario 2, affected households income increases by 0.3% and 0.16% for high- and low-income Mountain households, respectively, which is far lower that the percentage fall in the households respective income resulting from the externality (i.e. 0,74% and 4.66%, respectively). For scenario 3, the situation is better. The income increases by 0.57% and 3.25% for high- and low-income Mountain households, respectively. While the scenario is not as powerful as scenario 2 in boosting economic growth, it is slightly better than scenario 1 since it promises a 0.10% growth in economy compared to only 0.09% promised by scenario 1.

Considering employment generation, scenario 2 is the most effective in Lesotho. The scenario promises to generate total employment of M8.44 million with unskilled labor and capital getting the highest employment with M3.20 and M3.83, respectively (see Table 8.6). Notably, the impact of scenario 2 on both factors is almost the same. This is because the intensity of the two factors in agricultural production in Lesotho is almost the same. That is, a M1.00 external injection into Lesotho agriculture creates employment of M0.35 and M0.43 for unskilled and capital factors, respectively. Nonetheless, the fact that the capital factor has a higher multiplier explains why scenario 2 benefits high-income compared to low-income households (see Table 8.6).

TABLE 8.6: Effects of different policy scenarios on economies of Lesotho and SA (2000 million Rands)

	Scenario 1				Scenario 2				Scenario 3			
	Change in Lesotho income	% Change	Change in SA income	% Change	Change in Lesotho income	% Change	Change in SA income	% Change	Change in Lesotho Income	% Change	Change in SA income	% Change
Agriculture	3.10	0.12	-12.15	-0.013	18.26	0.68	-10.13	-0.011	8.16	0.30	-11.60	-0.012
Mining	0.03	0.07	-0.26	0.000	0.03	0.06	-0.32	0.000	0.03	0.06	-0.31	0.000
Manufacturing	7.61	0.08	-0.68	0.000	5.86	0.06	-2.67	0.000	7.03	0.07	-2.38	0.000
Electricity	0.19	0.04	-0.68	-0.001	0.26	0.06	-0.70	-0.001	0.21	0.05	-0.72	-0.001
Water	0.11	0.03	-0.20	-0.001	0.15	0.04	-0.20	-0.001	0.12	0.03	-0.21	-0.001
Construction	0.17	0.00	-0.20	0.000	0.24	0.00	-0.21	0.000	0.19	0.00	-0.21	0.000
Trade	1.22	0.06	-2.46	-0.001	1.07	0.06	-2.57	-0.001	1.17	0.06	-2.70	-0.001
Transport	0.51	0.07	-1.95	-0.001	0.36	0.05	-2.05	-0.001	0.46	0.06	-2.16	-0.001
Business	2.94	0.19	-2.62	-0.001	0.89	0.06	-3.15	-0.001	2.26	0.15	-2.87	-0.001
Community services	1.93	0.12	-0.63	0.000	1.13	0.07	-0.93	-0.001	1.66	0.11	-0.91	-0.001
FACTORS												
Skilled labor	0.54	0.04	-0.62	0.000	0.33	0.02	-0.76	0.000	0.47	0.04	-0.76	0.000
Semi-skilled labor	0.57	0.04	-0.33	0.000	1.08	0.08	-0.36	0.000	0.74	0.05	-0.38	0.000
Unskilled labor	0.73	0.04	-1.20	-0.001	3.20	0.16	-1.12	-0.001	1.56	0.08	-1.26	-0.001
Capital	1.70	0.07	-3.90	-0.001	3.83	0.17	-3.63	-0.001	2.41	0.10	-4.02	-0.001
INSTITUTIONS												
Enterprises	0.79	0.07	-2.30	-0.001	1.78	0.17	-2.14	-0.001	1.12	0.10	-2.37	-0.001
Mountain households high-in	1.92	0.80	-	-	0.30	0.13	-	-	1.38	0.57	-	-
Mountain households low-inc	7.44	4.82	-	-	0.16	0.10	-	-	5.01	3.25	-	-
Other households high-incom	1.87	0.04	-	-	4.15	0.10	-	-	2.63	0.06	-	-
Other households low-income	0.20	0.04	-	-	0.75	0.14	-	-	0.38	0.07	-	-
SA high income	-	-	-3.87	-0.001	-	-	-3.88	-0.001	-	-	-4.12	-0.001
SA low-income	-	-	-1.33	-0.001	-	-	-1.29	-0.001	-	-	-1.38	-0.001
Total	**33.56**	**0.09**	**-35.39**	**-0.001**	**43.84**	**0.12**	**-36.09**	**-0.001**	**37.00**	**0.10**	**-38.37**	**-0.001**

In the case of SA, the best scenario is 1. The general economy of SA contracts by M35.29 million compared to M36.09 and M38.37 millions promised by scenarios 2 and 3, respectively. In all the scenarios, the agricultural sector is likely to suffer most, with the three scenarios promising loss of income for the sector of M12.15, M10.13 and M11.60 millions by scenarios 1, 2 and 3, respectively. Expectantly, scenario 3 is still the worst in terms of SA households income generation. Compared to the other scenarios, scenario 3 promises total households income loss of M5.50 millions compared to M5.10 and M5.17 millions promised by scenarios 1 and 2, respectively. High-income households are likely to suffer most (see Table 8.6). This results from the fact that they are the owners of capital, which is likely to loose most in all the scenarios.

CHAPTER IX - SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

9.1 Summary

This study developed a general methodology that can be applied to integrating environmental sustainability aspects into economic development planning in the case of exploiting water resources through inter-basin transfers. Using the LHWP between Lesotho and SA, the study used the multi-country ecological social accounting matrix (MC-ESAM) for Lesotho and SA to integrate ecological implications of the LHWP in the economic benefits of the project. The study further used the developed MC-ESAM multiplier analysis to analyse the impact of lost ecological servies downstream the LHWP dams in Lesotho on the general economies of both Lesotho and SA. The results revealed that:

- The LHWP has significant direct and indirect economic benefits for countries involved in the project. For Lesotho the benefits consist of water royalties, hydropower and other benefits related to projects' construction. For SA the benefits comprise increased water supply for industrial and residential expasion in the Vaal region.
- Downstream the LHWP dams in Lesotho reside 150 000 riparians who reside within the reaches of the project rivers downstream the LHWP dams.
- Along and within the project rivers downstream the LHWP dams are a host of ecological (streamflow) resources and services supported by flows of these rivers, valued at M46.43 millions (see Tables 6.3 and 6.5).
- Riparians use the ecological resources and services to sustain their lives
- Due to the LHWP, the flows of project rivers downstream the LHWP dams will reduce with detrimental effects to streamflow resources and services, and resultant deleterious implications for livelihoods of riparians depending on the resources and services for wellbeing sustenance. Riparians welfare loss is

estimated to be M9 millions annually (see Table 6.4). This loss was not anticipated, and therefore not included in the EIA of the LHWP.

- While the loss of ecological resources and services is small, it is significant to populations residing downstream the LHWP dams and within the reaches of the project dams.
- The ecological resources and services' loss is very small compared to the LHWP's direct economic benefits and the water rents/royanties and thus can be easily compensated to restore the welfare of populations directly affected.

Because the SAM uses the SNA as database and that the SNA only includes values of resources/products and services traded in markets, ecological resources and services values, like the ones identified in the case study area, were not included in the Lesotho SAM used in this study. This means that the Lesotho GDP was underestimated by M46.43 millions in 2000. The MC-ESAM multiplier analysis indicated that not only mountain households, directly disturbed by the project, will be affected by loosing ecological services, but also the rest of households and the general economy of Lesotho due to direct, and indirect/induced multiplier affects. Because of strong economic links that exist between Lesotho and SA, i.e. Lesotho strongly depends on SA for imports, even SA households and general economy are likely to be affected by lost ecological resources and services in the mountain areas of Lesotho due to the project, though the impact is small in percentage terms because of the size of the impact compared to the size of SA economy.

Clearly, the LHWP has an externality in terms of the value of instream/ecological impacts of the LHWP. Since these impacts were never included in the EIA of the project, it means that SA, which is the ultimate beneficiary of the LHWP water, absorbs the externality as profits. Three policy simulation scenarios were analysed to determine the impact of internalizing the externality by SA on the welfare of households directly affected by the project in Lesotho, the rest of the households in

Lesotho and SA, and the general economies of both countries. Analysed policy scenarions were as follows:

(i) Money paid by SA to internalize ecological services loss is transferred to households directly affected by the project in Lesotho.

(ii) Money paid by SA to internalize ecological services loss used to finance agricultural programs in Lesotho.

(iii) 70 % of the money paid by SA to internalize ecological services loss used to finance agricultural programs and 30% transferred to affected households in Lesotho.

The first scenario (cash grants) was found to be the most effective in improving affected households welfare in Lesotho, but not sustainable and relatively ineffective in improving general economic growth. However, the second scenario was found to be the most effective in the general growth of Lesotho economy and employment of unskilled labor because of strong backward and forward linkages that agriculture has with other sectors within the Lesotho economy. In the case of SA, the least costly scenario was found to be scenario 1.

The ecological resources and services' loss of the LHWP derived in this study is significantly small compared to the project's direct economic benefits to both Lesotho and SA as outlined in Chapter II. Since SA is the ultimate beneficiary of the LHWP water, and thus absorbs the externality of lost ecological resources and services, it should compensate directly affected populations in Lesotho for welfare losses associated with the project in addition to the water royalties that it is already paying to Lesotho. The above policy scenarios are possible options that can be used to guide the administration of the compensation..

9.2 Conclusion

This study has clearly demonstrated that inter-basin water transfer projects

undoubtedly have significant direct economic impacts necessary for socio-economic development of economies involved in the project, they can seriously affect the capacity of water ecosystems to provide services and thus negatively impact on households' welfare, and that ignoring these effects can result in un-intended unsustainable development in the long-run. Leaving out instream/ecological effects of IBWT results in source sectors enjoying higher profits by not paying for the externality they cause. The value of lost instream benefits should be allocated to affected households. Because of interlikages that exist between different sectors in an economy and between economies, instream/ecological impacts of IBWT are likely to affect, not only those households directly linked to such projects, but also the entire economies of countries involved. In conclusion therefore, it is important to assess and measure instream/ecological impacts of IBWT, integrate the measured impacts into economic systems involved and analyse total impacts through an economy-wide framework to get a holistic measure of the impacts of intended inter-basin water transfer projects before implementing such projects.

While the impacts were relatively small for SA, they fall large on certain social groups of Lesotho people. It should be noted that the impact results have major limitations in that they did not include many important ecological values as indicated in Chapter VI and hence estimates are on the low side. Notwithstanding, the impact results have demonstrated that the LHWP is good for the country of Lesotho because of its direct benefits and water rents are highly significant compared to the instream losses of the project. These losses can thus be simply circumvented by mitigation measures or compensation for the affected households to ensure sustainable livelihoods. The results of this study have useful implications for future phases of the LHWP. If Lesotho and SA were to consider further phases of the project, it would be crucial to identify and quantify instream flows in an integral way before such phases are implemented to ensure sustainable development.

9.3 Policy implications

Important messages for policy decisions arise from the results of this study. While it is not debatable that IBWT are imperative for social and economic development, the results demonstrate that it is critical to consider and assess ecological consequences of IBWT before such transfers are implemented to ensure sustainable development of populations directly affected by the transfers. The affected parties in this case must be identified and compensated accordingly by sectors or countries absorbing the rent associated with ecological uses of water to ensure Pareto optimality.

The results of this study have also demonstrated the significance of assessing IBWT through an economy-wide framework. Because of interlinkages that exist between sectors within economies and between countries as demonstrated by the results of this study, implications of IBWT are felt by the general economies of the countries involved and the magnitude of impact in each country depends on the size of economies involved, degree of dependency in trade and factor employment, among others. It is therefore important that implications of IBWT are assessed through economy-wide models to help policy makers analyse distributional implications of such transfers even before they can be implemented. This would enable them make more informed and sustainable policy decisions.

A model that integrates ecology and multiple economic systems used in this study has clearly demonstrated the significance of analyzing IBWT impacts using an integrated approach. Although the empirical analysis and simulation results yielded small magnitudes in general, these magnitudes were significant for groups of people directly affected by the project in Lesotho. The results clearly showed that ecological implications of water transfers can have far reaching effects, depending on the magnitude of the transfers relative to the general economies of the countries involved. If this type of integrated approach is not followed in assessing impacts of IBWT, populations directly affected by the project may face unintended unsustainable

livelihoods in the long-term.

In conclusion therefore, it is imperative that before IBWT transfers are implemented, feasibility studies of such transfers carefully identify and measure instream/ecological implications of such projects before they can be implemented, and these should be integrated into economic implications of IBWT to ensure informed policy decisions that can lead to sustainable development. This integrated approach to impact analysis of IBWT is critically important at this point because the other phases of the LHWP are yet to be negotiated and the results of this study should help the project managers make informed decisions concerning further phases of the scheme.

9.4 Study limitations

While this study has produced insightful results and made important contribution to methodologies that can be used to assess impacts of IBWT, it has some limitations. To effectively measure the impact of the LHWP on the two countries involved using an economy-wide framework, it is important to assess the impact first on distinct project areas, and then on the general economies of countries involved. Based on the SAM analysis employed in this study, this requires five SAMs:

(i) The SAM for the project area in Lesotho (i.e. Katse and Mohale areas in the mountains region).
(ii) The SAM for the project area in SA (i.e. the Vaal region)
(iii) The general SAM for Lesotho
(iv) The general SAM for SA
(v) The multi-country SAM for the two countries, that integrates and clearly show the regional SAMs for the project areas and interlinkages that exist between project areas and general economies of own countries, between project areas themselves, projects areas and the rest of the world and between the two general economies and between the two general

economies and the rest of the world.

This approach is data intensive, which rarely exist, especially in developing countries. Therefore, this study did not use regional SAMs of project areas. Instead the analysis was performed on the general SAMs of the two countries.

To effectively apply the ESAM developed in Chapter V, it is important that environmental values/rents be measured and allocated to the source sectors e.g. Y_N, C_N, Y_Q, C_Q, W_Q, W_{NE}, R_N, X_{QN}, R_{QC} and R_{QE} in Table 5.1. However, because of data limitations, only aggregate values, i.e. Y_N, C_N, Y_Q and C_Q were estimated. In addition, this study only considered use values of streamflows and ignored non-use values of streamflows. Also, because of data limitations, ecological aspects of the LHWP related to SA were not included. Hence, this study was not adequate in integrating environmental values in the empirical MC-ESAM.

This analysis would have yielded more meaningful results if the analysis compared the scenario before the LHWP to that with the project. However, because this study used social accounting matrices for the year 2000, when the LHWP was already operational, for both Lesotho and SA, this could not be done. Consequently, this study could not isolate the total project impact.

IBWT schemes are often built over a number of years and their impacts, both economic and environmental, happen over time. As a result, a static model, used in this analysis, cannot tell the full story. Also, the SAM methodology used in this study makes restrictive production/technology and price assumptions. The CGE model on the other hand is more powerful than the SAM as it relaxes some of the restrictive assumptions made by the SAM. For this analysis, a better model would have been a dynamic CGE model that allows for temporal effects of IBWT and relaxes the SAM restrictive assumptions.

The accounting multipliers adopted in this study are derived from average expenditure propensities. Thus the multipliers assume unitary expenditure elasticities and that average and marginal expenditure propensities are equal. The inherent assumption is that computed average expenditure propensities are constant over any incremental exogenous injection. While this assumption may be easily rationalized for all other elements of expenditures like in the case of labor payments where the economy is operating below capacity in all sectors and labor incomes are proportional to employment levels, it is certainly unrealistic for the expenditure pattern of households. The study would have greatly benefited from data on household marginal expenditure propensities. In addition, the SAM is based on rigid assumptions of fixed coefficient production technologies, excess resources and thus fixed prices, and lack of input and output substitution.

9.5 Recommendations for further research

In view of the above limitations, the following are recommended for further research:

- The study be repeated using the multi-regional SAM to be able to gauge the LHWP impacts on both regions directly affected by the project and the general economies of the countries involved. This is crucial as the level of impact differs between areas directly disturbed and the general economy. Also, it is recommended that the analysis be repeated with the pre- and post-project SAMs to be able to isolate total project impact.
- More data that can enable isolation of ecological services and resources rents studied here be collected and the values be estimated.
- Data on non-use values of streamflow services and resources not included in this study be collected and the left out values be included to ensure adequate treatment of environmental values associated with the LHWP.
- Streamflow services and resources value impacts of the LHWP in SA be measured and included in this type of analysis.

- To avoid weaknesses of the static model used in this study, the same study be extended to a dynamic CGE analysis.