

Promethee Days 2020

S7 Applications

**Promethee method and Multiple criteria
performance analysis :
Telecommunications and Railways sectors
in North Africa.**

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Plan

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1. Introduction

- In North African countries, a considerable improvement of the situation of the Telecommunication operators and Railways sectors has been noticed during the nineties.
- The evolution in these countries was very different depending on their economic policies, their effort of reorganization and their technological change.
- The PRPMETHEE method of analysis provide the two dimensions of performance :
 1. The service to the community,
 2. And the enterprises performances, often in conflict.

2. Multi-criterion analysis by Promethee of the telecommunications performances of the Maghrebian operators

- The data concerning the telecommunications operators in the four Maghrebian countries during the period 1992–2001 are gathered in Table 1 hereafter while on Table 2, we computed ratios being free of the rates of money changes and inflation.

Table 1- Multi-criterion data representing the networks of 4 countries of Maghreb.

Networks of the country	Years	Outgoing total traffic [minutes] (1)	Personnel (full time) (2)	Principal lines (3)	Teledensity* (4)	Income [USD] (5)	Investment [USD] (6)	Population (*1000) (7)
Algeria	1992	118 014 368	19 208	962 247	36.627	245 192 307	173 397 435	26 271
	1993	78 289 000	22 712	1 068 094	39.715	287 066 381	148 479 657	26 894
	1994	79 000 000	18 492	1 122 409	40.820	250 114 090	108 528 237	27 496
	1995	84 332 632	18 423	1 176 316	4.921	224 464 960	77 465 379	28 060
	1996	93 040 368	18 554	1 278 142	44.743	227 506 849	128 493 150	28 566
	1997	157 712 352	18 817	1 400 343	48.213	224 345 867	98 631 086	29 045
	1998	121 282 248	18 230	1 477 000	50.056	287 248 893	146 305 754	29 507
	1999	143 415 168	17 809	1 600 000	53.422	290 821 691	114 465 975	29 950
	2000	151 837 328	17 900	1 761 327	57.965	305 607 228	105 465 311	30 386
	2001	209 191 000	17 900	1 880 000	60.968	361 642 061	96 464 646	30 836

Morocco	1992	102 577 360	11 484	654 000	25.600	563 700 234	257 611 241	25 547
	1993	125 073 168	12 632	827 000	31.724	500 537 634	193 655 913	26 069
	1994	130 011 616	13 396	1 007 000	38.621	550 108 695	269 130 434	26 074
	1995	129 986 000	14 626	1 128 000	42.373	659 367 681	312 412 177	26 621
	1996	129 343 496	14 772	1 208 000	44.461	695 183 486	197 591 743	27 170
	1997	149 570 000	14 208	1 300 528	47.261	683 001 049	180 797 481	27 518
	1998	181 000 000	14 150	1 393 355	50.316	773 541 666	131 666 666	27 692
	1999	219 500 000	14 068	1 471 000	52.786	867 857 142	237 346 938	27 867
	2000	245 000 000	14 511	1 425 000	49.643	1 128 880 526	221 072 436	28 705
	2001	270 000 000	16 200	1 191 335	40.841	1 415 929 203	229 209 687	29 170

Mauritania	1992	4 357 334	400	6 750	3.262	25 830 173	1 401 815	2 069
	1993	4 277 511	410	7 499	3.531	20 428 772	3 294 429	2 124
	1994	4 503 822	456	8 426	3.865	24 081 566	9 443 275	2 180
	1995	4 127 943	451	9 249	4.135	24 936 425	12 391 153	2 237
	1996	4 889 159	443	10 204	4.444	27 444 978	17 431 861	2 296
	1997	5 475 163	456	13 045	5.535	29 720 118	12 683 569	2 357
	1998	6 300 266	454	15 030	6.213	28 278 862	5 565 577	2 419
	1999	8 078 267	480	16 525	6.655	2 880 974	4 095 269	2 483
	2000	9 029 041	720	18 969	7.445	25 230 202	4 830 423	2 548
	2001	9 800 000	600	25 199	9.640	26 905 588	4 462 846	2 614

Tunisia	1992	68 767 000	7 500	374 848	44.329	200 000 000	126 136 363	8 456
	1993	69 392 000	6 314	421 362	48.679	194 000 000	129 000 000	8 656
	1994	80 000 000	6 432	474 253	53.978	218 811 881	121 782 178	8 786
	1995	87 529 704	5 800	521 742	58.217	262 105 263	134 736 842	8 962
	1996	94 052 984	5 975	584 938	63.984	296 907 216	198 969 072	9 142
	1997	97 903 000	6 221	654 242	70.821	326 126 126	138 738 738	9 238
	1998	115 000 000	6 421	752 180	80.576	350 877 192	156 140 350	9 335
	1999	140 000 000	6 567	850 381	89.892	378 151 260	104 201 680	9 460
	2000	164 000 000	7 011	955 131	99.638	400 729 927	159 124 087	9 586
	2001	174 000 000	7 400	1 056 209	108.887	475 694 444	212 500 000	9 700

* This column is expressed in: $\text{--}/1000$ inhabitants.

Sources: Algeria – Ministry for the Post and Telecommunication (MPT); Morocco – National Office of the Post and Telecommunications (NOPT); Mauritania – Office of the Post and Telecommunications (OPT); Tunisia – Tunisia Telecom.

Table 2 - Ventilation of the criteria according to the families and dimensions, the thresholds.

Outgoing total traffic [minutes] (1)	Personnel (full time) (2)	Principal lines (3)	Teledensity* (4)	Income [USD] (5)	Investment [USD] (6)	Population (*1000) (7)
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Dimensions, families, criteria	Threshold q	Threshold p	Criterion direction
Technical-economic evaluation			
Economic family of criteria:			
– traffic part for 1000 inhabitants = $(1)/(7)$	500	5000	Max
– traffic(*1000 min)/ sector income = $1000*(1)/(5)$	10	100	Max
– investment part for 1000 inhabitants = $(6)/(7)$	500	5000	Max
Lines family of criteria:			
– teledensity = (4)	5	50	Max
– number of lines/ number of personals = $(3)/(2)$	2	20	Max
– number of lines/ sector investment = $(3)/(6)$	1	100	Max
Sector performance evaluation			
Traffic family of criteria:			
– traffic/ number of lines = $(1)/(3)$	20	200	Max
– traffic/ number of personals = $(1)/(2)$	100	1000	Max
– traffic/ investment = $(1)/(6)$	0.25	1	Max
Income family of criteria:			
– sector income/ number of lines = $(5)/(3)$	200	2000	Max
– sector income/ number of personals = $(5)/(2)$	1000	5000	Max
– sector income/ sector investment = $(5)/(6)$	2	8	Max

Table 4 - Promethee II preference flows of performance by families of criteria by sub-periods for telecom in four Maghrebian countries.

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Years	Algeria					Morocco					Mauritania					Tunisia					Balances
	Traffic	Income	Economic	Lines	Total	Traffic	Income	Economic	Lines	Total	Traffic	Income	Economic	Lines	Total	Traffic	Income	Economic	Lines	Total	
1992	-14	-18	7	5	-20	-3	-2	-6	5	-6	30	30	-23	-16	21	-12	-10	21	6	5	0
1993	-12	-15	-6	0	-33	-1	-1	-1	7	4	6	24	-21	-17	-8	6	-8	28	11	37	0
Before change	-26	-33	1	5	-53	-4	-3	-7	12	-2	36	54	-44	-33	13	-6	-18	49	17	42	0
1994	-15	-12	-7	1	-33	-3	0	0	7	4	10	20	-20	-18	-8	8	-7	26	10	37	0
1995	-10	-14	-4	1	-27	-6	-3	-2	5	-6	8	20	-18	-19	-9	8	-3	24	13	42	0
1996	-15	-15	-1	0	-31	-6	-4	-9	4	-15	12	20	-13	-19	0	9	-2	24	15	46	0
1997	-5	-15	4	0	-16	-9	-5	-6	5	-15	9	19	-20	-20	-12	5	0	23	15	43	0
During change	-45	-56	-8	2	-107	-24	-12	-17	21	-32	39	79	-71	-76	-29	30	-12	97	53	168	0
1998	-15	-15	4	-2	-28	-3	0	-8	5	-6	14	18	-20	-20	-8	5	-3	23	17	42	0
1999	-17	-14	0	-1	-32	-10	5	-1	3	-3	20	12	-21	-20	-9	8	-3	21	18	44	0
2000	-6	-13	-1	2	-18	-4	11	-5	-1	1	8	1	-16	-20	-27	2	1	22	19	44	0
2001	-9	-13	1	6	-15	-5	14	-5	-6	-2	15	0	-16	-19	-20	-2	0	20	19	37	0
After change	-47	-55	4	5	-93	-22	30	-19	1	-10	57	31	-73	-79	-64	13	-5	86	73	167	0
Total	-118	-144	-3	12	-253	-50	15	-43	34	-44	132	164	-188	-188	-80	37	-35	232	143	377	0

Source: calculation of Karim Sabri from ARGOS results.

Table 3 - Promethee II preference flows of general performance dimensions by sub-periods for telecomin four Maghrebian countries.

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Years	Algeria		Morocco		Mauritania		Tunisia		Balances
	Enterprise performances	Service	Enterprise performances	Service	Enterprise performances	Service	Enterprise performances	Service	
1992	-32	12	-5	-1	60	-39	-22	27	0
1993	-27	-6	-2	6	30	-38	-2	39	0
Before change	-59	6	-7	5	90	-77	-24	66	0
1994	-27	-6	-3	7	30	-38	1	36	0
1995	-24	-3	-9	3	28	-37	5	37	0
1996	-30	-1	-10	-5	32	-32	7	39	0
1997	-20	4	-14	-1	28	-40	5	38	0
During change	-101	-6	-36	4	118	-147	18	150	0
1998	-30	2	-3	-3	32	-40	2	40	0
1999	-31	-1	-5	2	32	-41	5	39	0
2000	-19	1	7	-6	9	-36	3	41	0
2001	-22	7	9	-11	15	-35	-2	39	0
After change	-102	9	8	-18	88	-152	8	159	0
Total	-262	9	-35	-9	296	-376	2	375	0

Source: calculation of Karim Sabri from ARGOS results.

3. Synthesis and conclusion for the first case

- According the Promethee II multiple criteria comparisons of the four countries, taking into account the two general objectives of a utility enterprise :
 - ❑ The performances of the enterprises in the sector, on one hand,
 - ❑ And the service given to the community, on the other hand.

Table 5- The general rankings according Enterprise performances dimension and Service technical-economic dimension.

● Enterprise performances:	
1. Mauritania (296), 2. Tunisia (2),	3. Morocco (-35), 4. Algeria (-262);
● Service technical-economic:	
1. Tunisia (375), 2. Algeria (9),	3. Morocco (-9), 4. Mauritania (-376);
● Together:	
1. Tunisia (377), 2. Morocco (-44),	3. Mauritania (-80), 4. Algeria (-253).

4. A comparison of performances of the railways networks with PROMETHEE II

- The data concerning the railway operators in the four North African countries during the period 1990–2004 are gathered in Table 6 hereafter while on Table 7, we computed ratios being free of the rates of money changes and inflation.

Railway	Years	Traffic Units	T-km	cars	Total freight	Lines Km	Passengers	P-km	Cars	GDP(const\$)	Inhabitants	Area	Locos	Manpower
Algeria	1990	5168851	2178000	9985	12372965	5131	53664000	2990851	665	45,1	25,3	2381740	241	18200
	1991	5908827	2716736	10293	11958107	4047	57841000	3192091	637	44,6	25,9	2381740	238	18104
	1992	5433206	2529701	6259	11132763	4047	58422000	2903505	634	45,4	26,5	2381740	231	18187
	1993	5314312	2304584	10021	9700000	3945	59590440	3009728	632	44,5	27,2	2381740	227	17497
	1994	4512811	2278800	10322	9488542	3945	50241000	2234011	572	44,1	27,7	2381740	216	16780
	1995	3918000	2121000	10322	8600000	4246	44200000	1797000	628	45,7	28,3	2381740	221	16600
	1996	4127543	2301430	10424	8870878	4532	44522424	1826113	487	47,6	28,8	2381740	242	16269
	1997	4127543	2301430	10364	7900000	5021	44522424	1826113	481	48,1	29,2	2381740	275	16269
	1998	3337000	2174000	10336	8300000	4573	34100000	1163000	470	50,6	29,6	2381740	246	14400
	1999	3196251	2033000	10331	7800000	4268	34181887	1163251	465	52,2	30	2381740	246	14385
	2000	3121360	1979714	10118	7793351	3973	28324204	1141646	455	53,5	30,5	2381740	246	12510
	2001	2971000	1990000	10107	7800000	3831	28800000	981000	451	54,8	30,9	2381740	219	12300
	2002	3202000	2247000	10047	9300000	3855	28900000	955000	441	57,1	31,4	2381740	197	11400
	2003	3004409	2040892	10047	8167765	2888	27528637	963517	436	61	31,9	2381740	205	11420
2004	2897007	1947135	10026	8297367	3572	27258196	949872	440	64,1	32,4	2381740	207	11139	
Railway	Years	Traffic Units	T-km	cars	Total freight	Lines Km	Passengers	P-km	Cars	GDP(const\$)	Inhabitants	Area	Locos	Manpower
Egypt	1990	41561979	3028979	13500	10930000	4751	462931524	38533000	3554	65,7	55,7	1001450	927	88000
	1991	44427000	3276000	13240	10200000	4751	468157297	41151000	3477	66,4	56,8	1001450	829	88000
	1992	45800511	3211511	13000	10900000	4769	693000000	42589000	2906	69,4	57,9	1001450	820	88000
	1993	49479129	3141129	11147	10272000	4903	680800000	46338000	2996	71,4	59	1001450	831	71653
	1994	47914000	3621000	11468	11566000	4903	668201000	44293000	2969	74,2	60,1	1001450	840	72890
	1995	52314577	4072577	11671	12240000	4810	442000000	48242000	3129	77,7	61,2	1001450	984	74123
	1996	54582000	4117000	11673	12795000	4925	1090000000	50465000	3274	81,6	62,4	1001450	825	74015
	1997	56895000	3969000	12620	12000000	4925	1216000000	52926000	3656	86	63,6	1001450	779	71684
	1998	59265000	4265000	12724	12224000	5060	1314000000	55000000	3476	91,4	64,8	1001450	892	71062
	1999	63102000	3464000	12766	10830000	5024	1397900000	59638000	3476	97	66	1001450	873	71000
	2000	67060000	4000000	12958	12027000	5105	1397900000	63060000	3165	102	67,3	1001450	732	70900
	2001	70225000	4217000	12724	12036000	5179	1483500000	66008000	3165	106	68,6	1001450	692	70750
	2002	43271000	4188000	11592	11903000	5215	451000000	39083000	3069	109	69,9	1001450	687	70500
	2003	50289000	4104000	11959	11237000	5150	451000000	46185000	3069	113	71,3	1001450	680	70200
2004	57003000	4321000	12032	11814000	5150	451049961	52682000	3069	117	72,6	1001450	680	70000	
Railway	Years	Traffic Units	T-km	cars	Total freight	Lines Km	Passengers	P-km	Cars	GDP(const\$)	Inhabitants	Area	Locos	Manpower

Morocco	1990	7344622	5107346	9898	29048603	1893	11997328	2237276	579	26,7	23,9	446550	248	13716
	1991	6871632	4526170	8404	25965663	1893	12042115	2345462	618	28,6	24,4	446550	258	14002
	1992	7233818	5001100	8459	28360106	1907	11369047	2232718	620	27,4	24,9	446550	257	14157
	1993	6322655	4419089	8355	25504000	1907	9525000	1903566	542	27,1	25,5	446550	248	14349
	1994	6560407	4679216	8061	27303995	1907	9881017	1881191	562	29,9	26	446550	237	14385
	1995	6152093	4621201	7863	26911000	1907	8393253	1530892	580	28	26,3	446550	244	13782
	1996	6443606	4757208	7129	27329000	1907	9364694	1686398	432	31,4	26,6	446550	130	12639
	1997	6690622	4834688	6893	28818000	1907	11518884	1855934	372	30,7	26,9	446550	227	12016
	1998	6632000	4757000	6749	27076088	1907	11890000	1875000	372	33	27,2	446550	226	11600
	1999	6674499	4794499	6644	27948000	1907	12165000	1880000	372	33	27,5	446550	226	10905
	2000	6532000	4576000	6406	27129000	1907	13086000	1956000	294	33,3	27,8	446550	225	10308
	2001	6641000	4622000	6123	27493000	1907	13570000	2019000	294	35,4	28,2	446550	206	10200
	2002	7119000	4974000	6133	29945000	1907	14685000	2145000	288	36,6	28,5	446550	205	9800
	2003	7520694	5146525	5994	30402000	1907	16515724	2374169	288	38,6	28,8	446550	202	9487
2004	8207906	5563323	5707	32715000	1907	18543000	2644583	330	40,2	29,8	446550	202	9207	
Railway Tunisia		Traffic												
	Years	Units	T-km	cars	Total freight	Lines Km	Passengers	P-km	Cars	GDP(const\$)	Inhabitants	Area	Locos	Manpower
	1990	2877880	1858880	5007	9865000	1961	28594000	1019000	336	12,3	8,15	163610	189	9636
	1991	2839000	1820000	5007	9800000	1961	28600000	1019000	182	12,7	8,32	163610	199	9600
	1992	3093000	2015000	5109	10709000	2162	30654000	1078000	207	13,7	8,48	163610	195	9061
	1993	3069000	2012000	5244	10600000	2162	28200000	1057000	206	14	8,65	163610	189	8687
	1994	3263000	2225000	5220	11630000	2162	28268000	1038000	206	14,5	8,81	163610	189	8252
	1995	3313000	2317000	5097	12159000	2162	27660000	996000	203	14,8	8,95	163610	211	8364
	1996	3317000	2329000	4989	12262000	2168	28841000	988000	206	15,9	9,09	163610	211	8299
	1997	3434000	2338000	4879	12311000	2168	31447000	1096000	209	16,7	9,21	163610	378	8124
	1998	3494000	2358000	5121	12300000	1820	31500000	1136000	221	17,5	9,33	163610	189	8200
	1999	2829435	1636981	4642	12219976	2142	32200000	1192454	261	18,6	9,45	163610	189	6719
	2000	3221500	2029000	4011	12200000	2152	32200000	1192500	261	19,5	9,56	163610	189	6634
	2001	3539000	2282000	4642	12200000	2207	32200000	1257000	261	20,4	9,67	163610	61	6075
	2002	3554000	2273000	4447	12200000	2325	36900000	1281000	261	20,8	9,78	163610	68	5737
2003	3417000	2174000	4447	11500000	2162	35700000	1243000	261	21,9	9,83	163610	194	5554	
2004	3376193	2082193	3903	10891928	2281	35700000	1294000	261	23,2	9,93	163610	184	5507	
<p><i>Sources: Algeria: Société Nationale des Transports Ferroviaires (SNTF), Morocco: Office National des Chemins de fer (ONCF), Egypt: Egyptian National Railways (ENR), Tunisia: Société Nationale des Chemins de Fer Tunisiens (SNCFT), UIC; L'Union internationale des chemins de fer.</i></p>														

**Table 6 -Ventilation of the criteria
according to the families and
dimensions, the thresholds and the
criterion direction**

Table 6 -Ventilation of the criteria according to the families and dimensions, the thresholds and the criterion direction

Functions, families and criteria per family	Threshold q	Threshold p	Criterion direction
1- Technical assessment function			
<i>Freight traffic</i>			
<i>TKm/Traffic Units: Freight traffic part in TU</i>	1.5	4	Max
<i>TKm/cars: Freight cars employment</i>	20	50	Max
<i>TKm/Total Freight: Mean haulage length</i>	1.5	4	Max
<i>TKm/Lines Km: Freight traffic density</i>	15	35	Max
<i>Passenger traffic</i>			
<i>PKm/Traffic Units: Passenger traffic part in TU</i>	1.5	4	Max
<i>PKm/Cars: Passenger Cars employment</i>	100	250	Max
<i>PKm/Passengers: Mean journey length</i>	0.5	1.5	Max
<i>PKm/Lines Km: Passenger traffic density</i>	50	150	Max
2- Economics assessment function			
<i>Railways Economics performance</i>			
<i>Traffic Units/GDP: Rail economics intensity</i>	50	150	Max
<i>PKm/Inhabitants: population-oriented service</i>	50	150	Max
<i>Lines Km/Area: Network geographical density</i>	0.1	0.3	Max
<i>Firm's Global performance</i>			
<i>Traffic Units/locos: Locos employment</i>	20	50	Max
<i>Traffic Units/Manpower: Manpower productivity</i>	10	25	Max
<i>Traffic Units/Lines: Network Density</i>	70	170	Max

5. Synthesis and conclusion for the second case

- We constituted a hierarchy at 3 levels of the selected criteria.
- Here we have initially incorporated 3 basic criteria (or 4) to constitute a coherent family and that for 4 families, which are then gathered into two dimensions of analysis (also called assessment functions). (Colson and Mbangala, 1998.)

5. Synthesis and conclusion for the second case

- In order of analyzing by a multi-criterion method the performances of the railways sectors (networks) in the four North African countries, we based our analysis on two dimensions of performance of the public companies:
 1. Namely the effectiveness of the public service
 2. And the efficiency of those in terms of using resources.
- We borrow this methodology to Colson and Mbangala, (Colson and Mbangala, 1998.)

5. Synthesis and conclusion for the second case

- Table 8b contains a multi-criterion net preference flow indicating how much the corresponding country sector dominates the other ones in this family, if it is positive.
- A negative flow indicates how much the sector is dominated by the others in its family.

Table 8b – Promethee II preference flows of performance by families of criteria for railways in four North Africa countries.

	Algeria					TOTAL	Egypt					TOTAL	Morocco					TOTAL	Tunisia					TOTAL	Balances
	Freight	Passengers	Economic	Performance	Freight		Passengers	Economic	Performance	Freight	Passengers		Economic	Performance	Freight	Passengers	Economic		Performance	Freight	Passengers	Economic	Performance		
90	-17.5	-2.2	-15	-16	-50.7	-7.5	25	17.5	17.5	52.5	17.5	0	-7.5	12.5	22.5	7.5	-22.8	5	-14	-24.3	0				
91	-10.4	-5	-15	-7.5	-37.9	-9.6	25	17.5	20.5	53.4	15	-3	-7.5	7	11.5	5	-17	5	-20	-27	0				
92	-7.6	-4	-17.5	-13	-42.1	-10	24	17.5	20	51.5	17.4	-5	-7.5	7.5	12.4	0.2	-15	7.5	-14.5	-21.8	0				
93	-15	-5.5	-16.6	-12.6	-49.7	-5	25	17.5	22.5	60	17	-5	-7.7	5	9.3	3	-14.5	6.8	-14.9	-19.6	0				
94	-15	-8.4	-20.2	-18.6	-62.2	-5	25	17.5	22.5	60	16	-4.1	-8.5	7.5	10.9	4	-12.5	11.2	-11.4	-8.7	0				
95	-15	-10.6	-20	-20	-65.6	-5	21.8	17.5	22.5	56.8	17	-1.2	-7.5	7.5	15.8	3	-10	10	-10	-7	0				
96	-15	-10.6	-20	-20	-65.6	-5	21.8	17.5	22.5	56.8	17	-1.2	-7.5	7.5	15.8	3	-10	10	-10	-7	0				
97	-15	-14.5	-20	-17.5	-67	-5	21	17.5	22.5	56	17	0	-5.3	7.5	19.2	3	-6.5	7.8	-12.5	-8.2	0				
98	-13	-17.4	-22.5	-22.4	-75.3	-5	21	17.5	22.5	56	17	2.5	-5	7.5	22	1	-6.1	10	-7.6	-2.7	0				
99	-10	-21	-22.5	-20	-73.5	-5	21	17.5	22.5	56	20	5	-2.5	7.5	30	-5	-5	7.5	-10	-12.5	0				
00	-12.5	-17.5	-22.5	-20.5	-73	-5	21	17.5	22.5	56	17.5	5	-2.5	7	27	0	-8.5	7.5	-9	-10	0				
01	-10	-21	-22.5	-22.5	-76	-5	21.5	17.5	22.5	56.5	16	6.4	-2.7	2.5	22.2	-1	-6.9	7.7	-2.5	-2.7	0				
02	-7.5	-25	-22.5	-22.5	-77.5	-5	25	17.5	15	52.5	14.5	7.5	-2.5	7.5	27	-2	-7.5	7.5	0	-2	0				
03	-7.5	-25	-22.5	-16	-71	-5	25	17.5	17.5	55	14.5	7.5	-2.5	2.5	22	-2	-7.5	7.5	-4	-6	0				
04	-7.5	-25	-22.5	-22	-77	-5	25	17.5	17.5	55	14	7.5	-2.5	12.5	31.5	-1.5	-7.5	7.5	-8	-9.5	0				
T	-178.5	-212.7	-301.8	-271.1	-964.1	-87.1	348.1	262.5	310.5	834	247.4	21.9	-79.2	109	299.1	18.2	-157.3	118.5	-148.4	-169	0				

Source: Calculation of Karim SABRI from ARGOS software results.

5. Synthesis and conclusion for the second case

- The general rankings according to each of these 2 dimensions and together are thus (Table 8a):
Technical performances (TP): Morocco 1st (269.3), Egypt 2d(261), Tunisia 3d(-139.1), Algeria 4th(-391.2).
- Economics performances (EP): Egypt 1st(573), Morocco 2d(29.8), Tunisia 3d(-29.9), Algeria 4th (-572.9).
- Together: Egypt 1st(834), Morocco 2d(299.1), Tunisia 3d (-169), Algeria 4th (-964.1)

Table 8a - Promethee II preference flows of general performance functions for railways in four North Africa countries.

	Algeria		Egypt		Morocco		Tunisia		Balances
	Technical P	Economics P	Technical P	Economics P	Technical P	Economics P	Technical P	Economics P	
1990	-19.7	-31	17.5	35	17.5	5	-15.3	-9	0
1991	-15.4	-22.5	15.4	38	12	-0.5	-12	-15	0
1992	-11.6	-30.5	14	37.5	12.4	0	-14.8	-7	0
1993	-20.5	-29.2	20	40	12	-2.7	-11.5	-8.1	0
1994	-23.4	-38.8	20	40	11.9	-1	-8.5	-0.2	0
1995	-25.6	-40	16.8	40	15.8	0	-7	0	0
1996	-25.6	-40	16.8	40	15.8	0	-7	0	0
1997	-29.5	-37.5	16	40	17	2.2	-3.5	-4.7	0
1998	-30.4	-44.9	16	40	19.5	2.5	-5.1	2.4	0
1999	-31	-42.5	16	40	25	5	-10	-2.5	0
2000	-30	-43	16	40	22.5	4.5	-8.5	-1.5	0
2001	-31	-45	16.5	40	22.4	-0.2	-7.9	5.2	0
2002	-32.5	-45	20	32.5	22	5	-9.5	7.5	0
2003	-32.5	-38.5	20	35	22	0	-9.5	3.5	0
2004	-32.5	-44.5	20	35	21.5	10	-9	-0.5	0
Total	-391.2	-572.9	261	573	269.3	29.8	-139.1	-29.9	0

Source: Calculation of Karim SABRI from ARGOS software results.

6. Conclusion

- In general, we can confirm that all the networks analysed in this paper, like the majority of the public companies in the developing countries, have to do much effort to improve their performance mainly in management. For J.Nellis, Many African state-owned enterprises (SOEs), particularly those in infrastructure, have a long history of poor performance (Nellis, 2005).
- The reasons for the heavy African reliance on SOEs, and their unsatisfactory performance, are several.
- The failure of the African states gave rise to a reform approach relying much more heavily on private sector participation and ownership (Nellis, 1988).

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**Thanks for your
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