Promethee Days 2020 S7 Applications

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

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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 1992–2001are 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		Outgoing total	Personnel	Principal		Income	Investment	Population
of the	Years	traffic [minutes]	(full time)	lines	Teledensity*	[USD]	[USD]	(*1000)
country		(1)	(2)	(3)	(4)	(5)	(6)	(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	6750	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	2614

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: -/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	Personnel	Principal		Income	Investment	Population
traffic [minutes]	(full time)	lines	Teledensity*	[USD]	[USD]	(*1000)
(1)	(2)	(3)	(4)	(5)	(6)	(7)

Dimensions, families, criteria	Threshold q	Threshold p	Criterion direction
Technical-econ	omic 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 perforn	nance 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.

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

	Algeria					M	orocc	О			N	1aurita	nia			7	lunisi	a			
Years	Traffic	Income	Economic	Lines	Total	Тгаffіс	Income	Economic	Lines	Total	Тгаffіс	Income	Economic	Lines	Total	Тгаffіс	Income	Economic	Lines	Total	Balances
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:	calcul	ation o	of K	arim	Sabri	from	ARC	GOS 1	esul	ts.											

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

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

	Alge	ria	More	occo	Maur	ritania	Tun	isia	
Years	Enterprise performances	Service	Enterprise performances	Service	Enterprise performances	Service	Enterprise performances	Service	Balances
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.

- 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:										
 Mauritania (296), Tunisia (2), 	 Morocco (-35), Algeria (-262); 									
Service technical-econ	nomic:									
1. Tunisia (375),	3. Morocco (-9),									
2. Algeria (9),	4. Mauritania (-376);									
• Together:										
1. Tunisia (377),	3. Mauritania (-80),									
2. Morocco (-44),	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.

		Traffic												
Railway	Years	Units	T-km	cars	Total freight	Lines Km	Passenger <u>s</u>	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
		Traffic												
Railway	Years	Units	T-km	cars	Total freight		Passengers	P-km	Cars	GDP(const\$)	Inhabitants		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
Railway	2004 Years	57003000 Traff Unit	4321000 T.km	12032 cars	11814000 Total freight	5150 Lines Km	451049961 Passengers	52682000 P-km	3069 Cars	GDP(const\$)	72,6 Inhabitants	1001450 Area	680 Locos	70000 Manpower
Kanway	1 cars	Trair Chie	, r-kiii	cars	1 otal il eight	Lines IXIII	1 assengers	1 -KIII	Cars	Ant (consta)	THEORETICS	ATTEN	20003	Manpower

Morocco 1990 7344622 5107346 9898 29048603 1893 11997328 2237276 579 26,7 23,9 446550 248 13716 1992 7323818 5001100 8459 23836016 1997 11369047 2323718 620 27,4 24,9 446550 257 14157 1993 6322655 4419089 8355 25540400 1907 9325000 1903566 542 27,1 25,5 446550 248 14349 1994 6564047 4679216 8061 27303995 1907 9881017 188119 562 29,9 26 446550 237 14385 1995 6152093 4621201 7863 26911000 1907 8393233 1530892 580 28 26,3 446550 244 13782 1996 6443606 4757208 7129 27329000 1907 9364694 1686398 432 31,4 26,6 446550 237 12016 1998 6632000 4757000 6749 27076088 1907 1158804 1855934 372 30,7 26,9 446550 227 12016 12090 6532000 4576000 6406 27129000 1907 13066000 1956000 294 33,3 27,2 446550 226 11600 2002 711900 4974000 6123 27493000 1907 13570000 2150000 294 33,4 28,2 446550 225 10308 2001 5563323 5707 32715000 1907 14685000 2145000 288 36,6 28,5 446550 205 9800 2007 7256000 4974000 6133 29945000 1907 14685000 2145000 288 36,6 28,5 446550 205 9800 2007 7256000 4974000 6133 29945000 1907 14685000 2145000 288 36,6 28,5 446550 205 9800 2007															
1991 6871632 4526170 8404 25965663 1893 12042115 2345462 618 28,6 24,4 446550 258 14002 1993 6322655 4419089 8355 25504000 1907 9250000 1907 925000 1907 1903666 422 27,1 25,5 446550 237 14157 1994 6560407 4679216 8061 27303995 1907 9881017 1881191 562 29,9 26 446550 237 14385 1995 6152093 4621201 7863 26911000 1907 8393233 1530892 380 28 26,3 446550 244 13782 1996 6443606 4757208 7129 73239000 1907 9364694 1686398 432 31,4 26,6 446550 237 14385 1997 669622 4834688 6893 28818000 1907 11518844 1855934 372 30,7 26,9 446550 227 12016 1998 6652000 4757000 6749 27076088 1907 11518844 1855934 372 30,7 26,9 446550 226 11600 1998 6652000 4757000 6749 27076088 1907 11518840 1855934 372 30,7 26,9 446550 226 11600 2000 6532000 4576000 6406 27129000 1907 13086000 1956000 294 33,3 27,5 446550 226 11600 2001 6641000 4622000 6123 27493000 1907 13086000 1956000 294 33,4 28,2 446550 205 1909 2003 7520694 5146525 5994 30402000 1907 16853000 2145000 288 36,6 28,5 446550 202 9487 2004 8207906 5563323 5707 32715000 1907 18543000 2644583 330 40,2 29,8 446550 202 9487 2004 8207806 5563323 5707 32715000 1961 28594000 1019000 136 12,3 8,15 163610 199 9600 1993 3069000 2012000 5244 11600000 2162 28200000 1015900 206 14,5 8,81 163610 199 9600 1994 3331000 2317000 5097 12159000 2162 28200000 1015900 206 14,5 8,81 163610 189 8687 1995 3313000 2317000 5097 12159000 2162 28200000 115000 206 14,5 8,81 163610 189 8687 1996 3317000 2325000 4474 1150000 2162 28200000 115000 206 14,5 8,81 163610 189 8687 1999 3344000 2325000 4474 1	Morocco	1990	7344622	5107346	9898	29048603	1893	11997328	2237276	579	26.7	23.9	446550	248	13716
1992 7233818 5001100 8459 28360106 1907 11360407 2232718 620 27,4 24,9 446550 257 14157															
1993 6322655 4419089 8355 25504000 1907 925000 1903666 542 27,1 25,5 446550 237 14385 1994 6560407 4679216 8061 27303995 1907 981017 1881191 562 29,9 26 446550 237 14385 1995 6152093 4621201 7863 26911000 1907 8393235 1530892 580 28 26,3 446550 234 14385 1996 6443606 4757208 7129 27329000 1907 9364694 1686398 432 31,4 26,6 446550 237 12639 1997 6690622 4834688 6893 28818000 1907 11518884 1835934 372 30,7 26,9 446550 226 11000 1999 6674499 4794499 6644 27948000 1907 11518884 1835934 372 30,7 26,9 446550 226 11000 1999 6674499 4794499 6644 27948000 1907 12165000 1875000 372 33 27,5 446550 226 10905 2000 6532000 4576000 6406 27129000 1907 13066000 1956000 294 33,3 27,8 446550 225 10308 2001 6641000 4622000 6123 27493000 1907 13576000 2019000 294 35,4 28,2 446550 205 9800 2002 7119000 4974000 6133 279945000 1907 14683000 2145000 288 36,6 28,5 446550 205 9800 2003 7520694 5146525 5994 30402000 1907 18543000 2644883 330 40,2 29,8 446550 202 9207 Traffic 1786 185880 5007 9865000 1961 28500000 109000 182 12,7 8,32 163610 199 9636 1991 2839900 1820000 5007 9865000 1961 28500000 1019000 182 12,7 8,32 163610 199 9636 1992 2837800 1820000 5007 9865000 1961 28500000 1019000 182 12,7 8,48 163610 199 9636 1993 3313000 2215000 5244 16060000 2162 28260000 1015000 206 14,8 8,95 163610 189 8687 1994 3263000 2215000 5097 12159000 2162 28260000 1015000 206 14,8 8,95 163610 189 8687 1999 3331000 2338000 4467 12200000 2162 28260000 1015000 206 14,8 8,95 163610 189 8687 1999 3349000 2338000 4447 12200000 2162 23260000		1992	7233818	5001100	8459	28360106	1907		2232718	620			446550	257	14157
1994 6560407 4679216 8061 27303995 1907 9881017 1881191 562 29.9 26 446550 237 14385 1995 6413060 4757208 7129 27329000 1907 9364694 1686398 432 31.4 26.6 446550 224 1302 1997 6690622 4834688 6893 28818000 1907 1151884 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 6332000 4756000 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 225 10308 2001 6641000 4974000 6133 29945000 1907 13685000 2145000 288 36.6 28.5 446550 205 9800 2004 8207906 5563323 5707 32715000 1907 18543000 2644883 330 40.2 29.8 446550 202 9207 Railway Years Units T-km cars Total freight Lines Km Passengers P-km Cars GDP(consts) Inhabitants Area Locos Manpower 1991 28393000 1820000 5007 9865000 1961 28594000 1019000 207 13.7 8.48 163610 199 9600 1992 3093000 2015000 5007 9865000 2162 28060000 1019000 206 14.5 8.81 163610 189 8252 1993 3069000 2025000 5220 11630000 2162 28268000 1038000 206 14.5 8.81 163610 189 8252 1995 3313000 2239000 4879 12311000 2162 28268000 1038000 206 14.5 8.81 163610 189 8252 1997 3434000 2338000 4879 12311000 2168 28441000 186000 206 14.5 8.81 163610 189 8252 1998 344900 2338000 4447 12200000 2162 28200000 1192500 206 14.5 8.81 163610 189 8252 1999 3337000 2239000 4447 12200000 2207 32200000 1192500 206 14.5 8.91 163610 189 8200 1999 3334000 2338000 4		1993	6322655	4419089	8355	25504000	1907	9525000	1903566	542			446550	248	14349
1995 6152093 4621201 7863 26911000 1907 8393253 1586892 580 28 26,3 446550 244 13782		1994	6560407	4679216	8061	27303995	1907	9881017	1881191	562			446550	237	14385
1996		1995	6152093	4621201	7863	26911000	1907	8393253	1530892	580		26,3	446550	244	13782
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Source: 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; J.Union internationale des chemins de fer.

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

- 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.)

- 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.)

 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					Egypt					Morocco					Tunisia						
	Freight	Passengers	Economic	Performance	TOTAL	Freight	Passengers	Economic	Performance	TOTAL	Freight	Passengers	Economic	Performance	TOTAL	Freight	Passengers	Economic	Performance	TOTAL	Balances
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.

- 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										
	Alg	eria	Egy	pt	Mor	оссо	Tur				
	Technical P	Economics P	Technical P	Economics P	Technical P	Economics P	Technical P	Economics P	Balances		
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).

References

- Brans, J. P. Vincke, Ph. and Mareschal, B. (1986), "How to select and to rank projects: the Promethee method", Eur. J. Oper. Res., vol. 24, no. 2, pp. 228–238.
- Coelli, T. and Perelman, S. (1999), "A comparison of parametric and nonparametric distance functions: with application to European railways", Eur. J. Oper. Res., vol. 117, pp. 326–339.
- Coelli, T. D. Prasada, Rao, S. and Battese, G. E. (1998), An Introduction to Efficiency and Productivity Analysis. Norwell: Kluwer.
- Coelli, T. Estache, A. Perelman, S. and Trujillo, L. (2003), "A primer on efficiency measurement for utilities and transport regulators", Washington: World Bank Institute Studies.
- Colson, G. (2000), "The OR's prize winner and the software ARGOS: how a multi-judge and a multi-criteria ranking GDSS helps a jury to attribute a scientific award", Comput. Oper. Res., vol. 27, pp. 741– 755.
- Colson, G. and De Bruyn, Chr. (1989), Models and Methods in Multiple Criteria Decision Making, , Eds. New York: Pergamon Press.

- Colson, G. and Mbangala, M. (1998), "Evaluation multicritère d'entreprises publiques du rail", Fineco, vol. 8, no. 1, pp. 45–71.
- Colson, G. Sabri, K. Mbangala, A. (2006), "Multiple criteria and multiple periods performance analysis: the comparison of telecommunications sectors in the Maghreb countries", Journal of telecommunications and information technology, vol. 4/2006, pp.67-80.
- Craig, J. (2002), "Privatization and indigenous ownership: evidence from Africa", Ann. Publ. Cooper. Econom., vol. 73, no. 4, pp. 559–576.
- Desbois, D. (1995), "Enjeux économiques de la déréglementation sur les infrastructures de télécommunications", Terminal, vol. 68, pp. 31–44.
- El Yahyaoui, Y. (1995), "Les télécommunications à l'épreuve des mutations", Editions OKAD, Rabat.
- Estache, A. Kouassi, E. (2002), "Sector organization, governance, and the inefficiency of African water utilities", World Bank Policy Research, Working Paper 2890, September 2002.

- Estache, A. Perelman, S. and Trujillo, L. (2005), "Infrastructure Performance and Reform in Developing and Transition Economies: Evidence from a Survey of Productivity Measures", World Bank Policy Research, Working Paper 3514, February 2005.
- Färe, R. Grosskopf, S. Lindgren, B. and Roos, P. (1992), "Productivity in Swedish pharmacies 1980–1989: a nonparametric malmquist approach", J. Product. Anal., vol. 3, pp. 85– 1001.
- Färe, R. Grosskopf, S. Norris, M. et Zhang, K. (1994), "Productivity growth, technical progress, and efficiency change in industrialized countries", The American Economic Review, 84, pp.66-83.
- Mbangala, A. (2004), "Management of railways in Sub-Saharan Africa", Rail international, October, November, December, pp 13-21.
- Mbangala, M. (2001), "L'évaluation de la performance économique des entreprises publiques africaines par la méthode des comptes de surplus", Ann. Publ. Cooper. Econom., vol. 72, no. 2, pp. 183–207.
- Minogue, M. (2002), "Governance-based analysis of regulation", Ann. Publ.Cooper. Econom., vol. 73, no. 4, pp. 649–666.

- Nellis, J. (2005), The Evolution of Enterprise Reform in Africa: From State-owned Enterprises to Private Participation in Infrastructure - and Back?, Center for Global Development, Washington, U.S.A, 2005.
- Nellis, John. 1988. "The Institutional Framework: Organization, Management and Supervision of Tanzanian Parastatals." Unpublished chapter in World Bank report on Tanzanian public enterprises, 1988.
- Nellis, J. R. (1988), "Les entreprises publiques dans l'Afrique au Sud du Sahara", Washington: De travail de la Banque Mondiale.
- Plane P. (1999), Privatization, Technical Efficiency and Welfare Consequences: The Case of the Côte d'Ivoire Electricity Company (CIE), World Development, vol. 27, n° 2, pp. 343-360.
- Plane P. (2001), "Reforms of telecommunications in Sub-Saharian Africa", Tech. Rep. 174, OECD.

- Roy, B. (1996), Multi-criteria Methodology for Decision Aiding. Norwell: Kluwer.
- Sabri, K. (2005), "Une analyse multicritère dynamique des performances relatives des opérateurs de télécommunications au Maghreb. Travail de DEA en gestion", Liège, Université de Liège.
- Uri, N. D. (2000), "Measuring productivity change in telecommunications", Telecommun. Policy, vol. 24, pp. 439–452.
- Vincke, Ph. (1992), Multi-criteria Decision Aid. Chicherster: Wiley.
- Worl Bank (1994), "Infrastructures for developing countries", Rep. World Bank, Washington.

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Thanks for your attention.