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Sustainability and the Central Maghrib economies

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Recent scientific analysis has clearly underlined the fact that human beings face the difficult challenge of satisfying their economic needs without significantly altering the basic functions of the biosphere. Survival depends on satisfying those needs while simultaneously respecting ecological functionality such that a balance between the level of economic activity and environmental protection must be established. This challenge is probably greater in Southern countries than in industrialised ones, given that, in the former countries, human needs are far from being satisfied in an optimal manner. The purpose of this article is to examine the social, environmental and economic conditions facing Central Maghrib countries in the context of the risks they face regarding this sustainability challenge. In this sense, both because of its weak socio-economic and natural conditions, the Maghrib is one of the regions of the earth where this challenge is most evident.

Keywords: Maghrib countries; developing economies; sustainable development

The purpose of this article is to investigate to what extent the economies of the Maghrib – North West Africa – comprising the core states of Algeria, Morocco and Tunisia can meet the challenge of sustainable development in the medium term. The term ‘the Maghrib’ normally applies to both these states and the outlying states of Mauritania and Libya but these have been excluded for the purpose of this discussion because of the poor statistical data available. As will be shown, challenges from demography, land use, water availability and urbanisation in the coming epoch of climate change make this a crucial consideration for the political, social and economic futures of the states concerned. In many respects, these states are located in what is already a marginal environment where the situation can only worsen as climatic conditions deteriorate and this needs to be considered when the outside world proposes to them developmental models that appear to take little note of the realities ahead.

The natural frontiers of the Maghrib are the Mediterranean Sea to the north, the Atlantic Ocean to the west and the Sahara desert to the east and the south. In other words, the Central Maghreb is a homogenous geographic unit isolated from surrounding areas by sea and desert.

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It is made up of three different areas: a large and narrow fertile coastal band in the North; the Sahara Desert in the South (which occupies between 70% and 80% of the territory of the countries concerned); and a third area, situated between the others, consisting of mountains and a high plateau. This geographical homogeneity in space determines a degree of homogeneity in environmental conditions as well.

In addition to geography, the Central Maghrib countries show certain other similarities; they share a common history and culture as well as having experienced political and economic processes which have followed parallel trajectories. Thus, since the 1980s, the Central Maghrib countries – except for Algeria – have been seeking more effective integration into the world economy that would, they hoped, help them to mitigate their problems of underdevelopment. Algeria itself only began this process in the 1990s. In this context, given the harsh and often marginal environment in which their economies operate, a key political objective should be to create an appropriate socio-economic atmosphere for ‘sustainable development’.

The concept of sustainable development was introduced during the 1970s and has been generally accepted as a valid developmental concept since 1987, when it was defined as development that meets the needs of the present generation without compromising the ability of future generations to later satisfy their own needs. Many different views of sustainability have emerged since 1987, but two common features are implicit in all of them:

1. By providing inter- and intra-generational equity, development should not translate into additional costs for future generations; and
2. Sustainable development must be predicated on the need to consider the existence of three dimensions of sustainability – economic, social and environmental. The economic dimension requires an economic growth process where capital and resource use is efficient. This, however, is only a necessary but not a sufficient condition for sustainability. The social dimension implies greater social equity and the preservation of cultural diversity, whilst the environmental dimension means that pressures on the environment should be reduced.

This article, therefore, seeks to analyse the challenges that the Central Maghrib countries face from a sustainability perspective. Accordingly, the paper is structured as follows. The social dimension of sustainability will first be examined. Then the regional endowment in natural and environmental resources will be discussed. In the last section, the economic situation will be analysed, with an emphasis on regional economic structures, since this determines the competitiveness of Maghrib economies – their capability to generate income growth – in the context of the patterns of environmental quantitative and qualitative degradation that result. One problem has been that the data available are very limited so some of the data used are often not of very recent date.

The social dimension of sustainability

The key components of this aspect of sustainability involve issues of demography, urbanisation and quality of life. These are discussed below.

Demography

Demography is one of the most important factors that contribute to the difficulties of responding to the sustainability challenge in Maghrib countries, because of the predicted population growth and because of the changing patterns of population distribution as urbanisation progresses. Even

on the most conservative predictions for population growth, the pressure this will put on the environment and therefore on the sustainability of economic development will be massive. Even if the demographic transition model¹ (Sajoux Ben Seddik 2003, p. 186) is applied to predictions of future population trends, Maghrib countries will face strong population pressure over the next 25 years. Table 1 illustrates this situation; between 2000 and 2025, a cumulative 36% growth in population size is expected because of the preponderance of young people in the overall population.

The demographic dynamics shown above involves a significant pressure on economic resources and is a serious threat to sustainability. Since sustainability is attained when future generations are left with a stock of total capital similar to the present stock (Victor 1991, p. 191) population growth clearly puts great pressure on this total capital and threatens the possibility of maintaining it constant over time. Total capital is composed of natural capital (resources) and manufactured capital (economic output) and there is a certain degree of substitutability² between them. Indeed, throughout history, as the total human population has grown, natural capital has constantly been substituted by manufactured capital. However, there is a level of natural capital – the critical natural capital – which cannot be substituted by manufactured capital because environmental functions basic to the preservation of life on earth depend on it (Pearce and Turner 1990, p. 14)

In the Maghrib countries, increased population size will probably demand more manufactured capital and natural capital will have to be mobilised to provide it. However, the necessary growth in manufactured capital should not be achieved at the expense of critical natural capital and thereby harming the environment within which population growth occurs. The pressure on natural capital anticipated is primarily an indirect consequence of the high proportion of youth within Maghribi societies. This is highlighted by the annual growth rate of the Maghribi labour force which was 2.6% between 1990 and 2003 (World Bank 2005). Because labour markets have been unable to absorb this rate of labour supply, unemployment rates have averaged around 15 per cent of the labour force.

The only solution to the problem would be to increase productive activities in all three countries, in other words, to increase the regional manufactured capital. However, population growth would also press directly on natural capital, for more people involve greater energy demand and thus more atmospheric pollution. More people also entail more demand of cultivable land and this, in turn, leads to less forest and natural terrain, especially wetlands, developments which, in their turn, contribute to pollution and biodiversity losses (Pearce 1990, p. 223).

Uneven population distribution over territory also plays a major role in capital exploitation, particularly when, as in the Maghrib, the rate of population growth in rural areas is higher than in urban areas. For example, in Morocco the fertility rate was 2.3 per 1,000 in urban areas and 4 per 1,000 in rural ones in 2000 (Sajoux Ben Seddik 2003, p. 186). The consequence

Table 1. Evolution of the Maghrib population from 2000 to 2025.

Countries/years	2000	2010	2025
Algeria	30,332,000	34,929,000	42,329,000
Morocco	28,505,000	32,323,000	38,174,000
Tunisia	9,615,000	10,949,000	12,892,000
Maghreb	68,452,000	78,201,000	93,395,000

Source: Attane and Courbage (2001).

Table 2. Urban growth.

	Urban population (%)				Urban population ('000s)	
	1960	2000	2010	2025	2000	2025
Maghrib	31.6	53.8	59.2	67.6	35,966	59,733
Algeria	30.0	50.5	55.5	61.1	15,321	25,852
Morocco	29.0	53.8	58.8	65.6	15,370	25,053
Tunisia	36.0	58.3	63.5	76.1	5608	8828

Source: Attane and Courbage (2001). Urban population is defined as that living in towns of more than 10,000 inhabitants.

is urban drift – the migration of rural population to urban areas because rural economies cannot support such demographic pressure. Indeed, as Table 2 shows, urban population has increased at a faster rate than the total population; in 1960 one third of the total population lived in urban areas and in 2000 more than 50% did. However, the overall growth rates of both total and urban populations are decreasing, so cities are not expected to grow as rapidly in the future as they have up to now. Nevertheless, the urban growth rate is still very high and this has a direct negative impact on the environment (Batisse and Grenon 1990, p. 354) because:

1. Urbanisation consumes space, which affects the landscape, taking up agriculture lands, and littoral coastal areas; and
2. It leads to an increased water demand, waste water and solid waste generation, noise and air pollution.

For the Maghrib countries these impacts are greater because the urbanisation phenomenon is unplanned and spontaneous. Rural immigration is so intense that the real estate market is easily saturated, as are public services. The population tends to concentrate in ghettos where economic, social and environmental conditions are deficient. In addition, almost all the big cities in Maghrib countries are on the coastal littoral. There is, therefore, a huge difference in population density between these areas and the rest of the territory of each state. The differences are also economic, because most productive activities are located along the coast. Tunisia is the extreme example of this, with 90 per cent of industrial activities located on the littoral (Mahjoub 2002, p. 4). This 'littoralisation' of population has a negative environmental impact on the Mediterranean.

Quality of life in Maghrib societies

The economies of Maghrib countries generally have a relatively low level of development, a situation which has consequences for the living conditions of the population. The clearest evidence of this is the high poverty rate and high illiteracy levels amongst the population – an important constraint in the process of transition towards a sustainable society. Table 3 shows the living standards indicators for western Mediterranean countries and it demonstrates that the GNP per capita in Maghrib countries is around five times lower than those of their northern neighbours. Furthermore, with the exception of Tunisia, GNP growth rates are also lower. This indicator shows that Maghreb countries have not yet engaged in a process of income

Table 3. Living standards indicators in Western Mediterranean countries.

	GNP per capita (\$ ppp 2000)	% GNP growth/year	
		1975–2002	1990–2002
Spain	21,460	2.2	2.3
France	26,920	1.7	1.6
Italy	26,430	2.0	1.5
Portugal	18,880	2.9	2.5
Algeria	5760	– 0.2	0.3
Morocco	3810	1.3	0.8
Tunisia	6760	2.1	3.1

Source: UNDP, Human Development Report, 2004 (ppp = purchasing power parity).

growth which would lead to convergence with developed countries, a situation which hampers progress towards sustainability.

Table 4 provides the Human Development Index (HDI) rankings given in the United Nations' Human Development Report³ as well as the rankings for GNP. The HDI is, in effect, a qualitative indicator of development, in contrast with GNP, which is a quantitative indicator. A comparison of the rankings in HDI and GNP for the three Maghrib countries – undertaken for these purposes by subtracting one from the other – demonstrates a negative result which suggests that income growth does not contribute to an increase in the social and living conditions for the populations.

Another relevant indicator for socio-economic sustainability is the level of poverty, as shown in Table 5. It demonstrates that the proportion of the population living below the poverty line has

Table 4. Human development indicators.

	GNP/cap. (A)	HDI (B)	(A-B)
Algeria	83	108	– 25
Morocco	108	125	– 17
Tunisia	69	92	– 23

Source: UNDP, Human Development Report, 2004.

Table 5. Poverty rates in Maghreb countries.

Countries	Year	National poverty rates (% of population below the poverty line)		
		Rural	Urban	National
Algeria	1995	30.3	14.7	22.6
	1998	16.6	7.3	12.2
Morocco	1999	27.2	12.0	19.0
	1990	21.6	8.9	14.1
Tunisia	1995	13.9	3.6	7.6

Source: World Bank, World Development Report, 2003 and 2005.

Table 6. Literacy rates.

Countries	Adult literacy rate (% of people 15 years old and above)		Young Adult literacy rate (% of people between 15–24 years old)	
	1990	2001	1990	2001
Algeria	52.9	67.8	77.3	89.2
Morocco	38.7	49.8	55.3	68.4
Tunisia	59.1	72.1	84.1	93.8

Source: World Bank, World Development Report, 2003.

decreased very rapidly in Algeria and Tunisia. In Morocco, the proportion below the poverty line remains very high compared to the other two countries. Furthermore, in Morocco there are huge differences in the poverty indicators between urban and rural areas, with the poverty rates in rural areas being similar to those of less developed countries.

Table 6 provides data on literacy indicators. Even if the literacy rate is still low, significant improvements were accomplished between 1990 and 2001. Virtually all young adults in Algeria and Tunisia are literate, but the situation is not so impressive in Morocco.

To sum up, the rates of poverty have greatly decreased and the rates of literacy have greatly increased in Algeria and Tunisia, whereas the situation seems to be worse in Morocco. All in all, the improvement in the social indicators is necessary in a sustainability perspective should benefit from a significant income growth. This growth is likely to be based on manufactured capital.

The environmental dimension of sustainability

As in other places in the world, in this region environmental conditions are partly determined by geography and climate. Seventy-five percent of the territory is desert and the fertile region is constituted by a littoral strip which lies to the north of and in part includes the Atlas Mountains, consisting of the Atlantic coast in Morocco, a strip parallel to the coast with a depth of between 150 and 200 km in Algeria, and the north of Tunisia. Climate in this littoral strip is typically Mediterranean, with warm winters and very hot and dry summers. Rainfalls are very low (between 800 and 400 m/year) and are not evenly distributed over time or place.

Vegetation in the Maghrib is typical of Mediterranean climate zones, with brushwood and small bushes. As can be observed in Table 7, the forest surface is small, and it has remained constant over the last 10 years. However, the real forest area is smaller than the area officially classified as such. In Morocco, less than 60 per cent of the surface which is classified as forest or pasture is productive (VV.AA. 1990, p. 129). The typical vegetation which survives in the Mediterranean climate has an impact on the soil for Maghribi soils are fertile but weak; they can be exploited for agriculture but they are subject to a process of physical and chemical degradation. Through salinisation, erosion, destructuration, and desertification processes, for example.

Thus, one of the main environmental problems in Maghrib countries is the high level of soil erosion. For example, in Morocco, every year 22,000 hectares of the surface layer of soil is lost; in Tunisia the area lost is 18,000 hectares (VV.AA. 1990, p. 127). The erosion process is a consequence of action by both vegetation and climate, but is accelerated by human activity,

Table 7. Forest resources.

Forest surface as %age of total surface area	1990	2000
Algeria	0.8	0.9
Morocco	6.8	6.8
Tunisia	3.0	3.1

Source: UNDP, Human Development Report, 2003.

basically by agriculture. Another major environmental problem is water scarcity. This resource is scarcely sufficient to satisfy both domestic demand, and agricultural and industrial demand and demand on it is growing because of demographic trends. The result has been that many surface and sub-surface water reservoirs, such as the Albien aquifer system in Algeria, have been over-exploited and, throughout the region, water scarcity caused by over-exploitation is a severe problem at present (VV.AA. 1996, p. 180).

Water scarcity can be measured through an indicator which calculates water availability per capita. According to Mutin (2000, p. 28), the scarcity limit should be set at 1000 m³ per inhabitant per year. Below this threshold, a country is in a situation of regional water scarcity. If the limit is below 500 m³ per inhabitant per year, the situation can be considered to be critical, whereas with less than 100 m³ per inhabitant the country must use non-conventional water resources, such as using recycled used water or sea water desalination. Algeria has a massive \$14 billion desalination plan in operation which is to provide desalinated water to coastal cities.

Data on water availability are provided in Table 8. Only Morocco is outside the critical level, whereas Algeria and Tunisia are in a critical situation, in terms of ground and sub-ground water resources and in terms of the total amount of water available. Predictions about future water availability in Maghrib countries have generally been pessimistic. Furthermore, water resources in Maghrib countries are not only scarce but are also over-exploited. Human pressure on water can be measured by an exploitation index, which refers to the percentage of water used compared to the theoretical total renewable water reserves available (Benblidia *et al.* 1998, p. 12). When the index is below 25%, local threats to water quantity and quality exist; below 50%, there are more frequent generalised scarcities affecting a bigger geographical area; and at 100 per cent, there is generalised structural scarcity of water. In Algeria this index is 33%, in Morocco 39% and in Tunisia 59%. These percentages will increase in the next 20 years, to reach levels above 50 per cent in Algeria and Morocco and 70 per cent in Tunisia (Benblidia *et al.* 1998, p. 11).

The percentages of the population with sustainable access to an improved water source – a source where measures have been taken to avoid contamination – are provided in Table 9. The situation is generally worse for rural populations, but for both rural and urban populations,

Table 8. Water resources.

m ³ /capita	Interior renewable water resources 2000 ^a	Sweet water resources 1998 ^b
Algeria	442	485
Morocco	1058	1080
Tunisia	367	439

Source: ^aUNDP, Human Development Report, 2000; ^bWorld Bank, World Development Report, 2000/2001.

Table 9. Population with sustainable access to an improved water source.

	Rural population (%)		Urban population (%)	
	1990	2000	1990	2000
Algeria	–	82	–	94
Morocco	58	56	94	98
Tunisia	54	58	91	92

Source: UNDP, Human Development Report, 2003.

the situation has improved in every country except in rural Morocco. Table 10 shows that agriculture is the main consumer of water in Maghrib countries, so that agriculture is linked to the problem of water scarcity, as well as to the problem of erosion. In both cases, vegetation can play an important role as part of the solution to the problem, since forest and other vegetation sustain the soil and regularise the water cycle (Grenon 1992, p. 5).

In short, the situation concerning current and future water reserves in the Maghrib is worrying in terms of the quantity available. The problem is made much worse by the fact that the water quality of these reserves is also threatened. Pollution, coming from used water, enters the reserve as a result of urban, industrial and agrarian water use and would render a significant proportion of available water resources unusable without high-cost treatment to produce potable water (Sajoux Ben Seddik 2004, p. 7). In general, significant improvement in water management is essential. This would require improvements in the treatment of waste water and in its recovery. In this context, there is currently considerable interest in the implications of eliminating water subsidies and providing incentives to the population aimed at water conservation (Serghini 2002, p. 64; 2003a, pp. 9–11; 2003b, p. 5).

Air pollution is a further problem as comparative data for Maghrib countries and for their northern neighbours in Table 11 makes clear. Even if the level of emissions to the atmosphere are lower in Maghrib countries than in Southern Europe – as a result of their different levels of development – such emissions are growing in the Maghrib area, although, interestingly enough, chloroflourocarbon emissions have significantly declined. In any case, air quality in Maghrib countries will be probably be correlated with the development path they follow, and environmental quality will depend on the environmental policy they implement.

Indeed, in all three countries there is growing concern about environment conservation and preservation and, as a result, environmental agencies have been created in all of them. However, Chatelus (2003, p. 51) argues that governmental behaviour about this issue is ambiguous because environmental legislation is more and more demanding but governments lack the

Table 10. Share in water consumption 1990–1995.

	Households	Industrial	Agrarian
Maghrib	13.6	4.6	81.6
Algeria	22	4	74
Morocco	6	3	91
Tunisia	13	7	80

Source: VV.AA. (1996, p. 185).

Table 11. Air pollution index.

	CO ₂ emissions/capita		Consumption of CFCs (metric tonnes)	
	1990	2000	1990	2000
Algeria	3.2	3.0	3570	1022
Morocco	1.0	11.3	604	435
Tunisia	1.6	1.8	730	570
Spain	5.5	6.8		
France	6.3	6.1		
Italy	7.0	7.3		
Portugal	4.3	6.0		

Source: UNDP, Human Development Report, 2003.

capacity to execute it. In short, there is political will to commit to improving the environmental sustainability dimension of the Maghribi environment, but the scarcity and fragility of natural resources – which leads to a high level of critical natural capital in total natural capital – militates against this. The challenges of essential industrial development, with its inherent tendency towards the generation of pollution and the costs for these countries in implementing efficient environmental policies seriously threaten the chances of success in keeping pollution under control.

The economic dimension of sustainability

Economic sustainability concerns economic growth and, thus by extension, manufactured capital growth. Without economic growth, it is highly difficult to start a path towards sustainability overall, although it is also true that high economic growth does not necessarily guarantee sustainability either. Economic growth, in short, is a necessary but not a sufficient condition for sustainability to be achieved. Economic growth, overall, may lead to an income surplus and thus to higher levels of employment which, depending on how the benefits of such economic growth are distributed, may lead to an improvement in average living conditions (Burguillo 2002, p. 15) – the ‘technological effect’. Furthermore, when societies reach a certain level of per capita income there is a greater demand for environmental protection so that part of the income surplus may be used to finance the implementation of an efficient environmental policy. The environmental economics literature has argued that there is an inverted Bell-curve relationship between income per capita and polluting emissions due to income growth, known as the Environmental Kuznets Curve.⁴

However, sustainable development critically depends on the type of growth process that is taking place. This is related to the technologies being used and to the production structure of the economy. The production structure determines the environmental structure, or the relation of the economy to the environment, and factors of scale should also be taken into account (Burguillo 2002, p. 16). If the preservation of the environment is a priority, this will determine what the maximum size of economic factors in determining development – the ‘economic scale’ – can be. This, in turn, will determine the limits to the expansion of economic growth. Yet the actual limits are based on relative concepts because the relationship between economy and environment is both not easily measurable and depends on ideological

imperatives – an approach to environmental management which is inherently problematic. These issues are considered below through an analysis of the nature of economic growth in the Maghrib and a consideration of how income growth feeds into the ‘technological effect’ and the ‘scale effect’.

Primary economic sector considerations – agriculture

In Table 12 shows data concerning the share of the agricultural sector in the Maghribi economies. Although it is still high compared with developed economies, its importance is decreasing with respect to both, GDP and total employment. The most agrarian country is Morocco and the least is Algeria. This has to do with the different development policy options followed by each country after independence. Overall, the significance of agriculture to total employment is still very high in all three countries.

In short, the data demonstrates that agriculture is a key sector in the economies of the Maghrib. In Morocco, for example, according to Akesby (1995, p. 77) the results of agrarian harvests determine the rhythm of the domestic economy and the overall macro-economy’s external equilibrium – GDP growth, for example, closely matches the patterns of annual precipitation. Jordan Galduf (1991, p. 1943) observes that there is a consensus among economists that agriculture still plays a major role in economic development. It therefore follows that the agrarian sector should undergo major reforms to ensure that its production and productivity levels increase. As the crisis over food prices demonstrated in 2008, agriculture in developing countries should contribute towards food security and maximise outputs to sustain high population and urbanisation growth, a conclusion that particularly applies to the situation in the Maghrib.

Furthermore, agriculture also has an important environmental role for it is the economic activity that occupies the largest portion of the surface area and many of the crucial ecosystems are related to agriculture (Cadenas Marín 1995, p. 10). Thus agriculture shapes landscape and has an impact on natural capital because it uses the land both intensively and extensively as a source of resources and a sink for high entropy wastes. From an environmental point of view, therefore, agriculture has a greater importance than would be suggested by its share in GDP. Agriculture combines a set of crucial economic factors (land and technology), external inputs (chemical products, energy, and labour) and outputs (food and fibre), all related to the environment and to sustainability. Inputs, outputs and the system itself should be sustainable and links between agriculture, natural habitats and other economic sectors must be recognised (Pearce 1993, p. 116).

Table 12. Agriculture in Maghreb countries.

	% GDP		% working population	
	1990	2003	1980	1990
Maghrib	15	13	44	33
Algeria	11	10	36	26
Morocco	18	17	56	45
Tunisia	16	12	39	28

Source: World Bank, World Development Report, 1996.

In Maghrib countries, therefore, there is a close relationship between agriculture and the local environment: agriculture puts pressure on soils and demands water – a scarce resource – such that it plays an important role in the sustainability of the region overall. The ways in which agricultural systems are managed can profoundly influence these sustainable outcomes. In the Maghrib, this management of agrarian activities is both traditional and modern in style, a dual system which is typical of developing countries and has been one of the legacies of colonialism. During the colonisation period the system was developed by using the most fertile lands to produce crops, mainly specifically Mediterranean products, through modern techniques to satisfy metropolitan demand. Arid regions continued to use traditional, labour-intensive methods to satisfy domestic demand, mainly in cereals. These strategies have resulted in very low levels of agricultural productivity. In Table 13, the data for agricultural productivities between Maghrib countries and northern Mediterranean countries have been compared thus highlighting the great differences in levels of productivity between the two shores of the Mediterranean, a gap which continues to grow.

The low level of productivity could be explained by its extensive character for traditional agriculture occupies the largest proportion of the agricultural land in Maghrib countries (Aznar Sánchez 2002, p. 27). This type of agriculture, which is generally rainfed not irrigated, is subsistence in nature, being focused on cereal production for consumption within the sector. Its level of technological development is very low and crops and profits are highly dependent on climatic conditions, particularly rainfall. However, because production is so dependent on the climate and is designed for use by the consumer, it has little surplus for urban populations whose food has to therefore be imported. Thus, the consequence of this situation is food dependence one of the major socio-economic problems in the Maghrib.⁵

The modern agricultural sector, on the other hand, is linked to the urbanisation process, to changes in the composition of domestic demand and to the dynamics of external markets. It is mostly an irrigated agricultural system with a high degree of specialisation in Mediterranean vegetables and fruits and, in Morocco, on sugar. This agriculture uses advanced technologies and is integrated in the domestic and wider regional and global markets, supply, too, the agro-industrial sector. Its productivity is therefore higher than the traditional cereal sector and profits are less dependent on climatic change.

This modern agricultural sector is very important for the development of the Maghribi economies, for Mediterranean-style products have higher added value when exported to international markets. At the same time, the damage they can do to water resources because of the demand placed upon them by water use for irrigation needs to be born in mind and set off against the

Table 13. Agricultural productivity.

Added value per agricultural worker in 1995 \$	1988–1990	2000–2002
Algeria	1781	1919
Morocco	1823	1513
Tunisia	2228	3115
France	30,635	59,243
Italy	13,990	27,064
Portugal	5391	7567
Spain	12,860	22,412

Source: World Bank, World Development Report, 2004.

export implications of higher added value, as do the resource cost implications of non-traditional exports associated with the modern agricultural sector, such as exotic vegetables and flowers. Among the more traditional Mediterranean crops where there are not such negative resource implications, the olive tree and vine are notable for their capability of fixing the soil and avoiding erosion. These crops are present in all three countries, although the olive tree is mainly cultivated in Tunisia and the vine in Algeria.

The modern agriculture sector has also branched out into intensive pastoral farming, with a major focus on bovine and ovine production, alongside poultry production. This specialisation is complemented by traditional pastoralism but now seeks to satisfy the growing domestic demand for meat. It therefore plays little part in the export market for the region but acts to substitute for imports of meat products which would otherwise be necessary as domestic demand grows.

The marine fishing sector – both inshore and deep sea – is also important. In Morocco it represents a significant component of GDP, given the rich fishing banks in the Atlantic. In Algeria and Tunisia fishing is underexploited although there are plans in Algeria to modernise the fishing fleets and associated infrastructure. This sector can play an important role on the path towards sustainability through its potential for feeding the population and increasing the proportion of proteins in the Maghribi diet, as well as through its impact on the conservation of natural capital in the sea.

In essence, the agrarian sector can only contribute to Maghribi economic development if the problem of alimentary dependence on imports can be solved. This, in turn, depends on the environmental conditions in which it operates, namely the amount of fertile land available, the quality of the soil and the availability of water, as well as wider climatic considerations which are likely to become even more important as climate change develops. The outlook is, however, not good for, as Table 14 demonstrates, the land available per capita is diminishing and the advent of climate change may well accelerate the underlying problem of advancing desertification. This problem is certainly linked to environmental conditions.

In this context, more sophisticated irrigation techniques and technological advance are two elements which could contribute towards easing these problems, although, as mentioned above, they can carry their own threats to sustainability as well. This is particularly important if their exploitation implies increases in water consumption in a situation of scarcity and in the use of chemical inputs in a environment where soil structures are very fragile and easily suffer erosion. All three countries have depended heavily on intensive irrigation but have not been able to overcome the problem of food import dependence. As argued by Mutin (1995, p. 164), they produce what they do not consume, and they consume what they do not produce. One way in which this state of affairs could be improved – albeit at the cost of the loss of export revenues – would be to cultivate cereals on irrigated land. In short, in the

Table 14. Cultivable land per capita (ha).

Years	Algeria	Morocco	Tunisia	Maghrib
1967	0.52	0.51	0.88	0.64
1978	0.42	0.40	0.81	0.54
1990	0.27	0.28	0.56	0.37
2000	0.21	0.22	0.46	0.30

Source: Mutin (1995, pp. 133–178).

Maghrib, the agricultural sector could produce a significant technological effect but only at the price of a very high scale effect, because agrarian activities have a large impact on critical natural capital. The implementation of an environmental policy which would render the development of the agrarian sector compatible with environmental protection would be highly desirable.

The secondary sector – industry

Industry plays an important role in driving economic revival. In developed economies it does this through its capacity to innovate and in developing economies this is achieved through its demand for labour, which implies improvements through training for human capital, and through its export potential for generating revenues. Industry, therefore, generates important technological effects in sustainable developmental transitions.

It can also, however, cause scale effects which can be negative because of the following factors:

1. the space it occupies can have a negative impact on landscape, ecology and the environment;
2. industrial water demand, particularly in sectors such as agro-industry, steel, and pulp and paper production, is high;
3. industrial emissions are a major factor in air pollution and in water pollution; and
4. industry generates solid wastes as a result of the production process and through the discarding of obsolete industrial products.

The actual effect that industry may have on the sustainability of the economy, however, depends on the balance between these two effects and, as technology improves, in general, the adverse environmental consequences of industrial production diminish. Table 15 shows that, in the Maghrib, the industrial sector contributes more than one third of income generation.

In Morocco and Tunisia, the manufacturing sector is the main contributor to economic growth, mainly through agro-industry, textiles, electronic components and chemicals. These sectors employ a large proportion of the labour force and generate most of Morocco's and Tunisia's exports (Burguillo 1998, pp. 316–331). These sectors, therefore contribute significantly to a high level of technological effect in these countries. In Algeria, industry is the sector with the highest value-added but only because income growth is not based on manufactures but on

Table 15. Secondary sector.

	Share of industry ^a (% GNP)		Share of manufacturing sector ^b (%GNP)	
	1990	2003	1990	2003
Maghrib	36.6	37.6	15.3	14.0
Algeria	48	55	11	7
Morocco	32	30	18	17
Tunisia	30	28	17	18

Source: World Bank (2005).

^a'Industry' includes all industrial activities, including manufacturing and non-manufacturing sectors.

^bThe manufacturing sector includes all industrial activities consisting of the transformation of material inputs; non-manufacturing activities are those involved in the extraction of material resources.

hydrocarbons (Martin 2003, pp. 60–61). Exports and employment are highly concentrated in the hydrocarbon sector. This concentration is a sign of economic weakness for the sources of growth are biased towards a single economic sector and, in this sense, beneficial technological effects are threatened.

The scale effects related to industry may have an important impact on both the local environment in Maghrib countries and on the global environment. In terms of the local environment, growth in agro-industrial activities could lead to a high scale effect, for example, because of its indirect demands for water and land. In global terms, hydrocarbons, steel and chemicals sectors are very polluting in both absolute and relative terms. Agro-industry, textile and electronic component sectors are highly polluting in relative terms because, according to Burguillo (1998, pp. 395–416), their eco-efficiency is low compared to other manufacturing sectors.

Concluding remarks

The evidence gathered together above demonstrates that the Maghribi economies face a high rate of demographic growth which puts great pressure on natural capital. Furthermore, natural capital in the region is fragile because of the effects of the climate, now likely to worsen because of climate change, and for reasons of geographic location and structure. In such a context, income growth is necessary to sustain a growing population, but given the fragility of the natural resource base, this process must be made compatible with the preservation of environmental assets if a transition to sustainable development is to be attained. The challenge is severe because of socio-economic factors as well as the marginal nature of the regional environment. The solution to this challenge will depend on the composition of growth, for the structure of production will determine both the beneficial outcomes of technological advance against the potential negative consequences associated with the scale of income growth.

Such an outcome will require the involvement of industrialised countries. Indeed, the structure of production in Maghribi countries is, to a large extent, determined by international trade and investment flows. In this sense the European Union, their main commercial partner and the neighbour, with whom they share a natural frontier in the Mediterranean, could play a key role in Maghribi sustainability. Any improvement in the Union's partnership with the Maghrib should take the specific natural conditions facing these countries very seriously into account, alongside the urgent necessity for growth they face. Trade, but above all, direct investment should promote innovative technological transfer together with sustainable management technology and thus generate large employment opportunities, the ultimate key to development. The stakes are high but it is not clear that the European Union can rise to the challenge.

Notes

1. This reflects the change of population dynamics from one based on high birth and death rates to low birth and death rates over time as a result of economic and political development.
2. According to the weak sustainability thesis a necessary condition for sustainability is to maintain the total stock of capital constant over time. In contrast, the strong sustainability thesis argues that a necessary condition for sustainability is that the total stock of capital *and* the stock of natural capital remain constant.
3. This report has been published since 1990 by the United Nations Development Programme (UNDP) and it is designed to locate human well-being as the objective of development. The Human Development Index (HDI) is calculated for 174 countries. It synthesises three indicators: life expectancy, education level, and real GNP. The report classifies the 174 countries as a function of their HDI levels, then it compares this classification in terms of a GNP classification. Thus a higher level of GNP than HDI means that the income per capita has not

been efficiently used in human terms, so that economic growth has not contributed to an improvement in the quality of life.

4. This was introduced by Selden and Song in indirect analogy with the Kuznets Curve, which relates income distribution inequality and economic growth. For further information, see Selden and Song (1994). Many empirical studies have been developed since 1994 to test the Environmental Kuznets Curve. A survey can be found in Jayadevappa and Chatre (2000).
5. Food shortage is related to cereal consumption. Around 60% of the average Maghribi diet is based on cereals.

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