Small and Medium-Sized Cities and Insular Communities in the Mediterranean: Coping with Sustainability Challenges in the Smart City Context

Anastasia Stratigea, Akrivi Leka and Chrysses Nicolaides

Abstract As an introductory chapter, the present paper aims to set the geographical ground of this book by shedding light on a very special region of the world, the Mediterranean region. The scope of the chapter is, firstly, to illuminate the specific attributes of this region, which render it one of the most intriguing but also vulnerable regions of the world; and identify the character of the region as a 'hot spot' in several respects. Secondly, it aims to justify the type of cities considered within this geographical context, i.e. small and medium-sized cities and insular communities, usually lagging behind in terms of smartening up efforts; and having little opportunity to join a smart journey, as the public lights and related funding opportunities are usually shared by large, very successful, powerful and market attractive, smart cities that become examples on the global and the EU scene. Thirdly, the paper elaborates on the specific attributes and distinguishable rating of these cities in: economic terms (tourism, culture, sea trade nodes etc.); geographical terms (coastal and port cities at the cross roads of Mediterranean); cultural terms; etc. It reveals their development potential for both the Mediterranean and the EU context. A discussion follows on the emerging risks in the Mediterranean, which place at stake the sustainable future development of this type of cities and communities. Digitally enabled solutions, in conjunction with

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sustainability policies, appear as a full of promises path and an evolving policy direction for reaching inclusive, safe, resilient and sustainable end states within such a full of challenges new era. Finally, some concluding remarks are discussed as to the planning approaches that need to be in place for coping with threats and sustainability challenges in this specific part of the world.

Keywords Mediterranean region · Sustainability · Small and medium-sized cities and communities · Insular communities · Smart Sustainable Cities (SSC)

1 The Current Mediterranean Profile—Potential, Challenges and Risks

> For the three quarters of the globe, the Mediterranean Sea is similarly the uniting element and the centre of world's history.
>
> Friedrich Hegel

At the crossroads of three continents, Europe, Africa, and Asia, the *Mediterranean Basin* refers to the sea and lands around the Mediterranean Sea. Mediterranean Basin is surrounded by *21 countries—Albania, Algeria, Bosnia-Herzegovina, Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Libya, Malta, Monaco, Montenegro, Morocco, Slovenia, Spain, Syria, Tunisia and Turkey—*, which share a coastline of 46,000 km. It constitutes a very special region of the world from a *nature's point of view*, with huge topographic, climatic and geographical variability. More specifically, it is characterized by: a highly contrasting topography, exhibiting a remarkable topographic diversity and altitudinal differences, coupled with spectacular scenery; and a combination of land and island complexes, together with a quite large number of islands of different shapes and sizes, nicely placed in the Mediterranean Sea. Moreover, the unique mild and temperate climate; the beautiful landscapes; the rich marine environment; and the abundant but also unique biodiversity, have each played their role so as the Mediterranean Basin to be considered as one of the biological wonders and the third richest biodiversity landspot of the world (Mittermeier et al. 2005).

Rivaling the natural diversity of the region, its cultural, linguistic and socioeconomic diversity is also spectacular. The *cultural wealth* has largely been attributed to the mutual influence of its surrounding eastern and western civilizations through historically deployed important commercial routes, but also travelers of ancient times that allowed for trade and cultural exchange between the emerging societies in the region. Dense human populations have been scattered across the area for several millennia. The region has given rise to some of the world's first and greatest civilizations, while it has been considered as the *cradle of Europe's civilization* as well as the place that fuelled the Renaissance Era. It has given birth and became home to great thinkers and artists, such as Aristotle, Plato, Cicero, Socrates,

Leonardo da Vinci, Michelangelo, Galileo etc. It is also the home of all Seven Wonders of the World.

The *economic wealth* of Mediterranean societies has been mainly determined by the sea, which has affected the development of economic and trade relationships, but also of societal ties with other Mediterranean communities. Trade and economic transactions were largely concentrated in the coastal areas, with Mediterranean coastal communities being rendered very prosperous and flourishing ones thus rising to power. The sea provided a means for trading, but also for colonization and wars, thus becoming the core of life for numerous communities throughout the ages; and a valuable resource for economic activity (commerce, fishing, tourism, etc.).

The *north-south fracture* is also evident in regions of the Mediterranean Basin, sketched by an economically rich and ageing northern Mediterranean rim (mostly EU member states); and the younger and poorer southern and eastern rims (Arab states).

The *northern developed rim* is mainly characterized by urban and industrialized societies with high to medium income levels, low population growth, a steadily increasing and intensifying agricultural production pattern, combined with a decreased rural population. Existing there is a highly developing urbanization trend, with evident consequences on urban density and quality of life; as well as an increasing tourism trend in rural areas.

The *southern and eastern less developed Mediterranean rim* has low-medium income levels, high population growth rates, some of the globe's highest urbanization pace, relatively high population density in rural areas, while local economic sectors are highly dependent on natural resources for their livelihoods.

As the Mediterranean region is a top tourist destination on a global scale, with tourism being considered as a *major pillar for the local economies* especially in coastal zones, an increasing *pressure* is exerted on local natural resources, which results in their rapid degradation due to uncontrolled construction interventions (transport infrastructure, hotel complexes, holiday homes or expanding cities sprawled out in all directions), water stress, waste production etc., through serving the needs of the quite large, and steadily increasing on a yearly basis, number of visitors.

The north-south fracture, combined with the recently evolved political instability and tensions in the southern part, have stirred up a significant *migration flow*, a *migration tide* as many claim, from the poorer south to the richer north, which at the end of the day has taken the form of an *evolving migration crisis* with considerable, not yet fully grasped, implications on the social and economic structure and stability of both origin and destination regions.

The study of the *key socioeconomic features* of the Mediterranean region reveals that (CEPF 2010):

- The region hosts 6.5% of the world's *population* (480 million inhabitants) (EEA and UNEP/MAP 2014). Increasing population rates are much higher in the southern and eastern part, where population has doubled over 30 years, reaching

234 million inhabitants, a number that is expected to further increase by additional 70–120 million by 2030, placing a certain population increase pressure. On the other side of the coin, population increase in the northern part reached 14% over the same period, while it is expected to increase by only a mere 5 million by 2030. Almost one third of the Mediterranean population lives on the shore, a fact that significantly impacts the marine ecosystems and the health of the surrounding coastal areas.

- Based on the mild climate as well as the natural and cultural heritage, the Mediterranean region attracts a huge number of tourists. Almost one third of international tourism (32%) flows through Mediterranean; and this flow has seen a four-fold increase in the time span from 1970 to 2000, further expanding to today. The assumption for 2025 is a continuation of the strong growth of tourist flows, with another 178 million additional arrivals (Plan Bleu 2006).
- It produces 13% of world's GDP, a picture that seems to recently follow a declining trajectory due to the economic recession, affecting Mediterranean countries.
- It follows a *development pattern* that is still highly dependent on environmental resources, consuming them in an unsustainable way (demand for natural products and services is much larger than the local ecosystems' ability to renew them). Unsustainable paths of tourist development, with emphasis on mass coastal tourism, further deteriorate sustainability performance, with severe impacts on water (in quantitative and qualitative terms) and energy over demand.

Future conservation efforts need to address *population pressures* on the land, especially in the coastal zones, where coastal overdevelopment results in a concentration of pressures on coastal areas, giving rise to issues that impact continuously evolving infrastructure deployment (e.g. erosion), and above all, issues on how to maintain traditional rural livelihoods in a way that benefits biodiversity, particularly where urbanization is high.

The Mediterranean basin has nowadays been considered as a *hotspot in multiple perspectives*. More specifically it has been perceived as:

- An *environmental hotspot*: this is due to the overexploitation of local resources especially in the marine part.
- A *climate change hotspot* (EEA 2015): this is based on estimations depicting a general future trend of warming and drying for the Mediterranean Basin, with multiple socioeconomic implications and stresses (health, energy, water, food safety and security, further habitat and biodiversity loss, fire risk, lower rates of annual precipitation, etc.) (Giannakopoulos et al. 2005; Lionello et al. 2008).
- A *biodiversity hotspot*: Mediterranean exhibits nowadays the lowest percentage of remaining natural vegetation compared with any other hotspot. Many forests have been converted to agricultural land, while urban space is rapidly expanding to the detriment of rural land (CEPF 2010).

- A *water hotspot*: Mediterranean is an area facing a constantly increasing rate of water stress (ARLEM 2011), while if no action is undertaken, predictions show that by 2025 half of Mediterranean countries will use more water than the one naturally regenerated (Sundseth 2009). Water footprint per person shows that five Mediterranean Basin countries (Cyprus, Greece, Italy, Portugal and Spain) are rated among the top 10 worst progressing nations worldwide in this respect. Tourism seasonality and its massive mass model contribute to the further worsening of water stresses.
- A *natural risk hotspot*: Mediterranean cities are historically exhibiting high vulnerability regarding disastrous natural events, such as floods and earthquakes. Floods are expected to further increase in the MED region, as a result of climate change. As far as earthquakes are concerned, MED is a high seismic area, with a high density of seismic events being located in the southern part of EU countries and the Aegean Sea.
- An *urbanization hotspot*: Mediterranean region is one of the world's most populated areas, showing an intensive and steadily increasing urbanization pattern. Such a trend results in a range of severe impacts relating to energy consumption, water resources, air pollution, traffic, soil sealing and respective loss of arable land, etc.
- A *solid waste generation hotspot*: in the MED region is generated *almost half* of EU waste, which shows a further increasing trend (15% growth of waste generation in the southern Mediterranean over the last decade) as a result of the escalating population and the increasing consumption pattern. With EU targeting a 70% recycling rate of household waste by 2030, less than 10% of the Mediterranean household waste collected is currently being recycled (EEA 2015). Waste management needs significant improvement, but a new culture is also required through educating local population towards a more rational behaviour in this specific issue.
- An *economic recession hotspot*: debt crisis of European countries has led to a deep recession, affecting in a more severe way the Mediterranean countries. Austerity measures, declining earnings, but also high rates of unemployment have burdened households' incomes and have led, among others, to: the collapse of aggregate demand; the intensively increasing bankruptcy rate of small and medium sized enterprises, further worsening an already preexisting high unemployment rate; and the increase of the number of people living below poverty level.
- A *brain drain hotspot*: poor economic performance, combined with the economic recession affecting Mediterranean countries has had, and continues to have, severe social consequences. Youth unemployment reached 'record' levels on both rims, with many countries recording unemployment rates between 20 and 30% (Plan Bleu 2006). As a result, a considerable number of young, highly qualified scientists are migrating in search of a more promising professional life and future, marking thus the currently evolving brain drain phenomenon.

Based on the above discussion, it seems that cities and communities throughout the whole Mediterranean region have been trapped into a resource-intensive model of development that renders them quite fragile in front of the current global challenges. This statement can be sustained by relative studies, proving the fact that the ecological footprint of each country in the Mediterranean Basin exceeds nowadays ecosystems' resource renewal potential (CEPF 2010). Not having so many options to revert the whole undesirable situation, it seems that the necessary *trend-breaking* efforts towards decreasing communities' ecological footprint can be supported by recent ICT developments and the emerging *smart city paradigm*. Incorporating this into integrated mitigation and adaptation urban but also rural strategies, urban and rural regions can cope with resource constraints and succeed to pave the way towards a more promising and qualitative life for both local population and visitors. And this has to be carried out in a rather hard period in terms of economic recession and scarcity of financial resources, factors that place at stake efforts of small and medium-sized Mediterranean cities and island communities to go smart.

2 Why Mediterranean? Why Small and Medium-Sized Cities and Island Communities?

The effort undertaken in this book has a specific *geographical focus* in the Mediterranean area. The reason for this lies on the value all contributors place on this region, and the previously presented—social, economic and environmental—peculiarities this area exhibits; as well as the largely looming future perspectives of the specific area in the light of current global challenges, as these are predicted by various studies around the Mediterranean future state.

Moreover, the book has a specific *focus on small and medium-sized cities and island communities* in a smart city perspective. This is largely justified by the:

- Large *number* of these type of cities spread around the Mediterranean Sea;
- *Island configuration* of the area and the need to cope with additional *barriers* (e.g. natural isolation), hampering equal access to services, opportunities, etc.
- Role as globally appreciated *natural and cultural heritage nodes*, developed by close interaction and historical/cultural bonds shared by the Mediterranean cities through centuries, rendering them, among others, attractive tourist destinations on a global scale.
- Role as nodes of interaction in the context of *sea routes—the MED port cities*—crossing the Mediterranean Sea, thus gaining importance as commercially attractive spots; while placing also additional problems and sustainability challenges that such a role entails.
- *Commonalities* of the general features of MED cities and communities, particularly their human scale, livability and social cohesion, conviviality of their neighborhoods, and their geographical cohesion and historical character, factors that constitute an ideal of sustainable urbanism in many ways.

- *Shared destiny* in respect of a number of challenges related to climate change, migration, deterioration of sea environment, austerity, water scarcity etc., which underline the necessity of cooperating and implementing "smart" solutions tailored to their attributes in order to jointly create conditions for a more sustainable and smart resource management pattern.
- Role that small and medium-sized city environments can play in the well-being of their own inhabitants but also the surrounding rural populations.

Grounded on current studies and literature around the Mediterranean area, mostly the EU part, this section attempts to briefly illuminate a few quite important issues that advocate the choice *of small and medium-sized cities in the Mediterranean territory*, mainly addressing their *particularities*, which are setting the framework of Mediterranean cities as a whole. These are shortly presented in the following and relate to the:

- Small and medium-sized cities
- Island complexes in the MED Sea
- Port cities
- Coastal cities
- MED cities as Cultural/Tourist nodes

Small and Medium-sized Cities Small and medium-sized cities represent nowadays a distinct attribute of the European settlements' network with the majority of cities falling into this category. Indeed, a recent study by Dijkstra and Poelman (2012), exploring the European network of cities, reveals that from a total of 828 cities of the European territory (cities in EU-27 plus Iceland, Norway, Croatia and Switzerland), *688* (almost 83%) *fall into small* (50,000–100,000 inhabitants—420 cities) and *medium-sized cities* (100,000–250,000 inhabitants—268 cities) (Fig. 1a); while *305* (almost 37%) of those small and medium-sized cities *lay in the EU Mediterranean region* (Fig. 1b).

Small and medium-sized cities and especially island communities in the Mediterranean, but also in Europe, are somehow *lagging behind* in terms of "*going smart*" *initiatives*, when compared to respective smart developments of larger European cities. They are in most of the cases the "*late comers*" in terms of adoption of innovative technologies, governance and financing models, which could enhance their potential for grasping smart cities' opportunities for sustainable urban management. Building momentum for those cities in the specific area seems nowadays to be of crucial importance for their survival and flourishing, as well as for enhancing their potential to cope with the impacts of economic recession, by establishing new opportunities for innovation, job creation and reversal of the brain drain trend. Furthermore, experience gained from this effort can, in perspective, uncover hidden potential of small and medium-sized cities in EU as a whole, a fact that can positively affect prosperity of regions and population of the European territory.

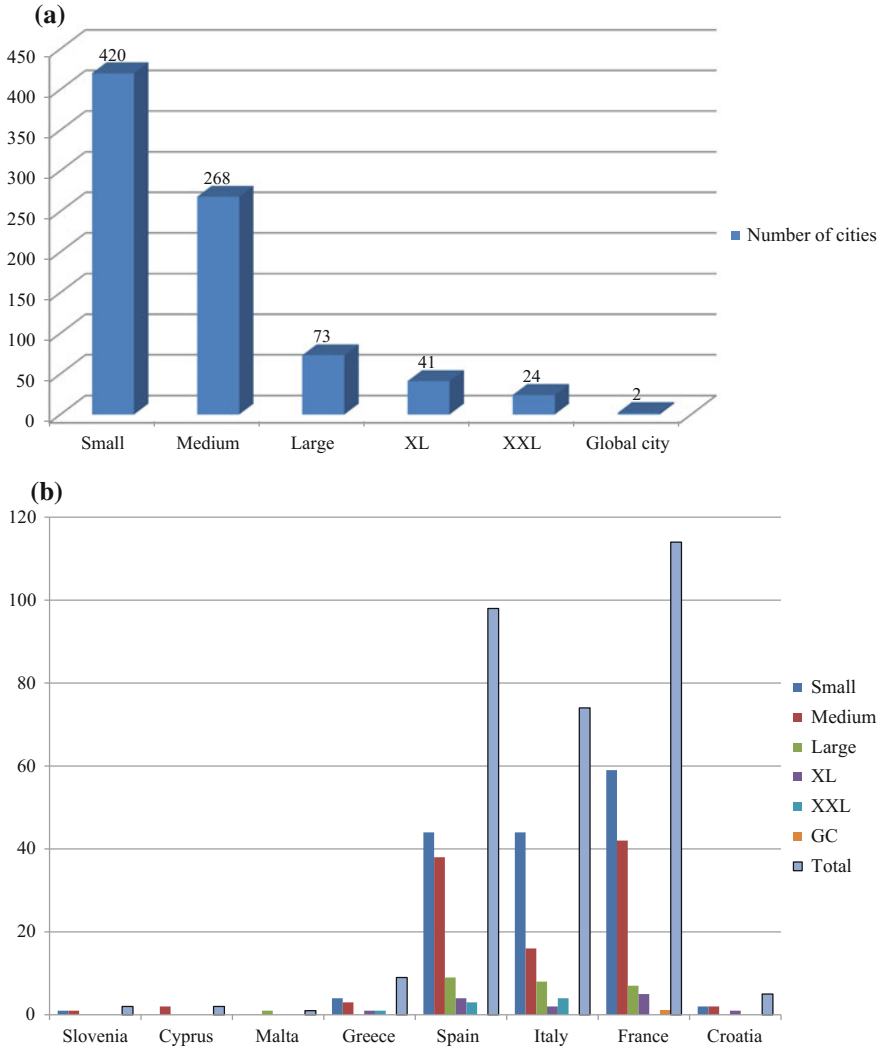

Fig. 1 EU Cities. **a** EU cities per size (EU-27 plus Iceland, Norway, Croatia and Switzerland) (Total: 828 cities). **b** EU MED-cities per size and country (Total: 305 cities)

Island complexes in the MED Sea A *second very distinct attribute* of the Mediterranean territory is the *large complex of island communities*, present in the MED Sea (199 islands with surface larger that 5 km^2) (Fig. 2). The majority of them are spread in the Aegean and the Adriatic Sea; while almost half (50.7%) belong to the Greek state.

Islands in the Mediterranean are considered as pieces of land disposing quite valuable natural and cultural characteristics, which have rendered them important

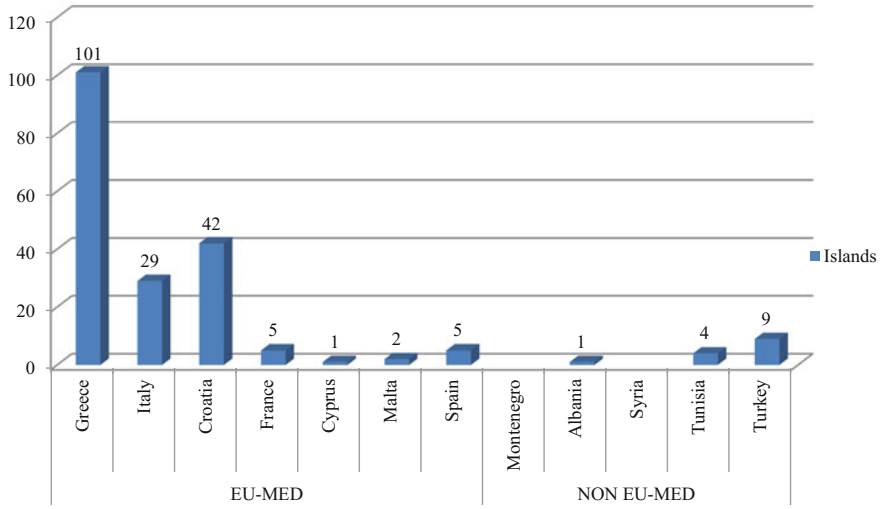

Fig. 2 Number of MED-islands per EU and non-EU country (islands with surface > 5 km^2)

nodes for tourist development. Indeed tourism constitutes nowadays a significant pillar of the island economies, but also a sector that is the cause of stress in social and environmental terms (Taberner and Manera 2006). At the same time, they are marked by limited size and lack of economies of scale; various types of bottlenecks due to their geographical peculiarity, poorly developed infrastructure and low accessibility to services (transport, health, education, etc.); limited natural, human, economic resources; digitally-illiterate and of low educational level population, etc.

Port cities A *third critical attribute* distinguishing Mediterranean Sea from other parts of the world is the dense ports' network expanding along the coastal part of the area. Throughout its history, the Mediterranean Sea was a heavily used and highly valued transport waterway, with maritime activity being a distinct element of its identity and human presence for centuries. Nowadays, is one of the world's busiest shipping routes, accounting for 15% of global shipping activity; while almost one third of international sea-borne volume originates from or is directed towards the approximately *300 ports* located in the Mediterranean Sea (UNEP/MAP 2012). Between 1985 and 2001, a tremendous increase of 77% was recorded in the volume of ship cargo loaded and unloaded in Mediterranean ports (Abdulla and Linden 2008), a trend that is expected to grow three or four-fold in the next 20 years, with such a growth being mainly marked by increasing ships' size and traffic.

Moreover, ports in the EU-28 handled 400 million *maritime passengers* in 2013. Greek and Italian ports handled roughly twice as many maritime passengers in 2014 as in any other EU Member State, with their 75 million and 72 million passengers respectively accounting for just less than one fifth of the EU-28 total. Denmark (41 million passengers) had the next highest number of maritime passengers, followed

by Germany, Sweden, the United Kingdom, France (2013 data), Croatia and Spain, with each handling between 23 and 31 million passengers in 2014 (Eurostat 2016).

Port cities in the Mediterranean are of crucial importance in respect of sustainability objectives. As nodes of local and global importance, they are sources of *economic and social gains* at both the:

- *Local level*, constituting engines of economic growth and development and thus important sources of employment and income; while new opportunities are opening up, emanating from the rising of blue growth strategy and the expected benefits to be reaped by its proper implementation in each specific MED city port.
- *Global level*, giving rise in a competitive edge in international trade due to their attraction as: economic and commercial nodes; global transport hubs and gateways in international transport routes; and homes of powerful industrial clusters, located in port cities and their surrounding areas.

In total, the Mediterranean Sea hosts *99 main ports* with population larger than 50,000 inhabitants, out of which 75 ports are falling into EU countries and 24 in non-EU (data on different ports' population range between 2011 and 2014) (Wikipedia data on MED-ports 2016 and data on EU (MED-)ports from EC 2013) (Fig. 3).

The importance of port cities from the *economic and social perspective* can be grasped by their role as job creation hubs. According to OECD estimations for European port cities, each additional million tons of port cargo creates 300 new jobs in the port region in the near term; while on a global average, one million tons of port cargo in port cities is associated with 800 jobs (OECD 2013), rendering port cities sources of economic gains and jobs' creation in the short and long term.

From an *environmental point of view*, maritime traffic and port installations as well as the whole industrial complex usually built around the maritime sector in port cities has a range of negative impacts, affecting quality of marine and land environment of port cities concerned. These can relate to sea water pollution and underwater noise disturbance, hazardous waste production, air pollution due to maritime traffic as well as the functioning of port-related establishments necessary for serving their needs, traffic congestion around the port area with certain consequences in terms of air pollution and energy consumption, etc. Land use impacts are also an important variable in port development, affecting the functioning and spatial structure of port cities.

Coastal Cities Nested along the lengthy coastal part of the Mediterranean region (46,000 km length), lies a large number of cities, of varying size and peculiarities. Increasing importance is attached to these cities, attributed to their advantageous geographical location and the multiple roles/functions/perspectives that can be attached to them due to this location. This importance is largely justified by their potential to act as developmental poles in both a *green* and a *blue*, currently on-going, growth policy direction.

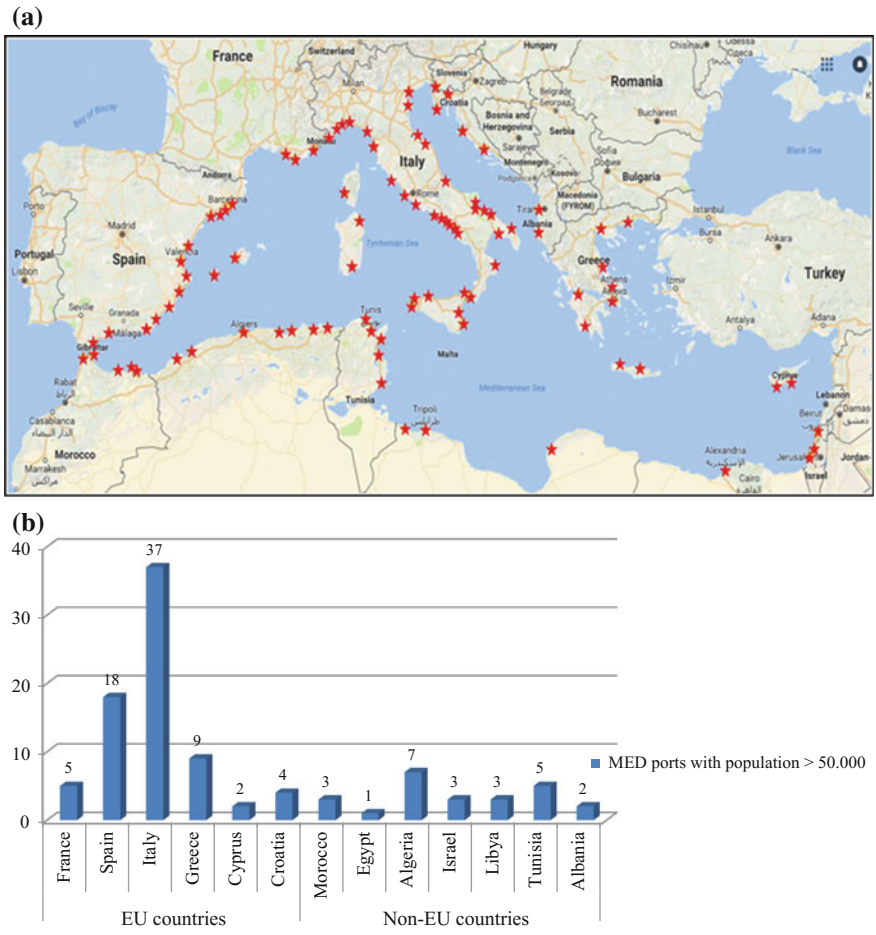

Fig. 3 Mediterranean ports. **a** Spatial distribution of main ports in the Mediterranean region. **b** Number of main ports per country in the Mediterranean region (ports with population larger than 50,000 inhabitants)

More specifically, coastal Mediterranean cities can act as *integrated multi-sectoral economic development hubs*, following: *green development paths* in sectors such as residence, industry, tourism and recreation; and *blue development paths*, hosting a variety of blue growth activities, such renewable energy production, fishing and agriculture activities, activities based on the exploitation of abundant mineral resources, sea transport as well as sea recreation and tourism activities.

Towards this end, a number of issues has been raised as to how sustainability objectives can be ensured and how to cope with land use conflicts emerging from high demand for land from these activities; while new challenges are also emerging in respect of the co-existence potential of various activities, so that a more effective

land and resource use can be achieved. Quite important in this respect is spatial planning, incorporating both the land and marine dimension; and engaging a wide variety of stakeholders for a more successful and inclusive decision-making process.

MED region (cities) as cultural/tourist hub(s) The Mediterranean region in general (both northern and southern shores), but also Mediterranean cities in particular, hold a major appeal for the *tourism/leisure* market, rendering them by far the most attractive and highly appreciated tourist destinations at a global level; and the world's most visited regions. The Mediterranean area, mostly in its coastal part (seaside summer holidays), attracts almost one third of the world's international tourist flows (300 million in 2008 and predicted 368 million by 2020); and generates more than a quarter of international tourism receipts. This picture is expected to follow an ascending trend, whereas tourist flows are predicted to reach 500 million international tourist arrivals by 2030 (UNWTO 2013). Current but also future predicted developments in the tourism sector play a vital role in local economies, rendering tourism a pillar of local economic growth and employment; and a major player in a country's external balance of payments (ACE 2012).

Mediterranean's coastal areas are mostly visited for holiday and leisure purposes, with cultural urban tourism, coastal and maritime as well as cruise tourism being the prevailing tourism forms appearing in the region. Recently, other tourism forms are gradually gaining ground, such as health or professional/business tourism and alternative tourism forms such as ecotourism, religious tourism, business tourism, conference tourism, etc., contributing to the diversification of the tourism package and the gradual removal of seasonality, being a dominant attribute/problem of the tourism sector in this specific region.

3 Great Challenges Ahead—Vulnerabilities of the MED-Region

The Mediterranean Region is in the present millennium in front of a number of great challenges. Grounded on current more specialized studies, this section makes an effort to summarize and roughly sketch the '*hot*' *issues* that are nowadays considered as the challenges ahead in this specific area, with cities playing an important role for both the creation of relative problems but also their solutions in the light of both behavioural as well as technologically-enabled policy directions regarding these solutions.

A *first critical challenge* refers to the rapidly growing *urbanization pattern* in the Mediterranean area that proceeds with a rather faster pace compared to the rest of the world. This pattern has actually shown a tremendous increase during the last half of the past century. An indicative picture of this phenomenon is provided by Plan Bleu (2006), showing that the number of cities with 10,000 or more inhabitants has exhibited a dramatic increase from 1950 to 1995 (from 1923 to 3392

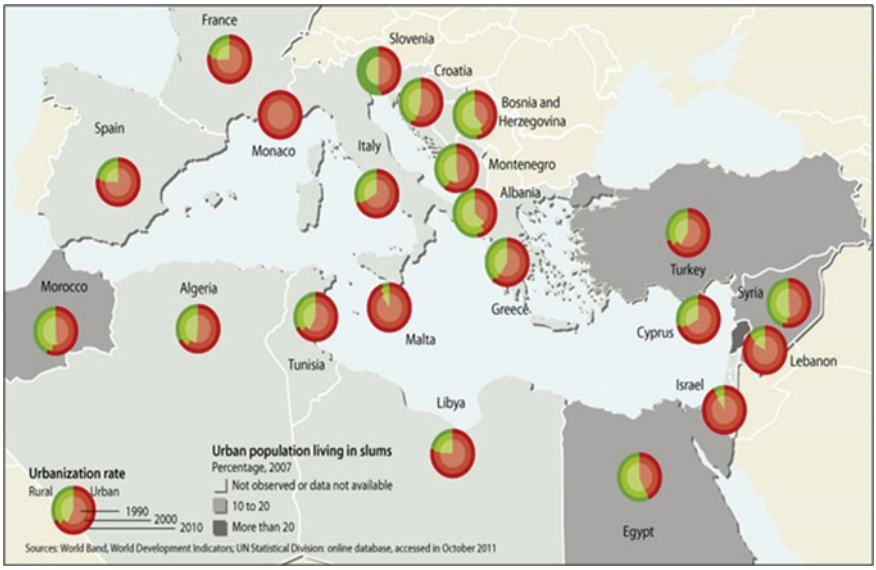

Fig. 4 Evolving urbanization pattern 1990–2010. Reproduced from GRID-Arendal (2013)

cities, an increase of 76%). Same picture is provided by ARLEM (2015), where it is depicted that in the time span 1970 and 2010, the urbanization rate around the Mediterranean increased from 54 to 66%, with the southern and eastern Mediterranean part being urbanized more rapidly than the rest of the world. The above evidence in fact reflects the spectacular rise of urban population and a steadily increasing urbanization pattern in the Mediterranean area, further continuing in the third millennium (Fig. 4).

Nowadays the Mediterranean region hosts a population of approximately 480 million people, who live across the three continents surrounding the Mediterranean Sea. This population has exhibited *fast increasing rates*, mostly noticed in the European Neighborhood Policy (ENP) South Group countries, i.e. Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine, Syria and Tunisia (Fig. 5). Projections of population trends until 2050 (United Nations 2009) show a certain population stabilization in the northern (EU) rim of the Mediterranean, while population increase in the southern and eastern part is expected to follow a rapidly ascending order.

Almost one-third of the Mediterranean population is concentrated along its coastal regions. Moreover, more than half of this population (250 million people or 55% of total population) resides in coastal hydrological basins, with this share escalating to 65% in the southern region of Mediterranean (around 120 million inhabitants). Population increase results in an uncontrolled urban sprawl, partly taking the form of informal settlements, which are mostly associated with a variety of environmental, social and economic problems and degrading environment as

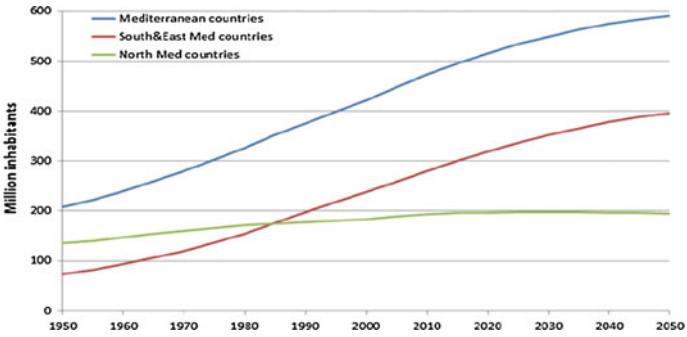

Fig. 5 Growth of population in the Mediterranean—Time span 1950–2050. Reproduced from United Nations (2009)

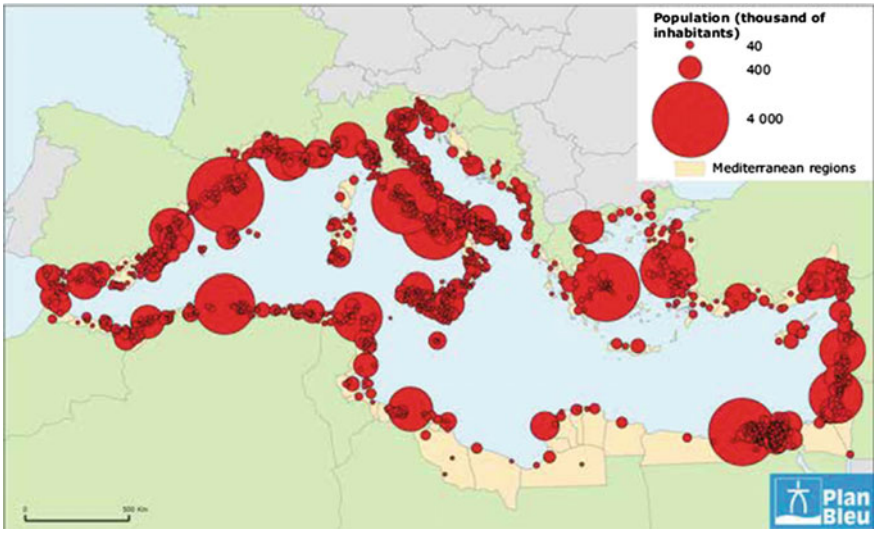

Fig. 6 Population of coastal Mediterranean cities in 2013. Reproduced from EEA and UNEP/MAP (2014)

well as lack of sufficient service and infrastructures; while at the same time, such settlements become the usual "victims" of various climate change impacts e.g. floods, resulting to acute devastations and even life loss.

Of importance is also the fact that a large part of the coastal area of Mediterranean is urbanized (25,000 km out of the total of 46,000 km of coastline), with *coastline urbanization* having already exceeded a *critical limit* (ACE 2012). Evidence shows that the urban population in all riparian Mediterranean countries grew from 94 million in 1950 (44% of total population) to 274 million in 2000 (64% of total population), an increase that challenges stability of the local resource balance (Fig. 6).

Quite distinguishable urbanization patterns are exhibited in the southern and eastern part of the Mediterranean—*the most rapidly urbanized part of the world*–, where 74% of population is expected to become urban by 2025 (Plan Bleu 2006). Lanquar (2013) links high urbanization rates of this part to coastline urbanization, associated with rapid tourism development, which evolves quite larger in annual rates than the northern Mediterranean rim [growth rates of international tourist arrivals in the northern Mediterranean rim (Southern European countries) in the time span 1995–2020 (observed and projected) is 3.8%; while in Eastern Mediterranean climbed to 6.9%] (UNWTO 2000: 54). This holds true for example for Tunisia, which has urbanized large parts of its coastline; Morocco that has opened up new beach resorts—the Mediterranean Pearl—, Turkey and other Eastern Mediterranean countries as well. Such a development of *mega-destinations* in the coastal part largely contributes to rapid urbanization and land use conflicts along the coastline, while it certainly places a huge burden threatening also the marine ecosystem.

Rapidly growing urbanization seems to be nowadays a *major risk* in the Mediterranean coastal part, leading to an *ecological overshoot*, with demand for products and services exceeding ability of local ecosystems to renew them; rapid expansion of urban land use and soil sealing through the replacement of arable-pastoral land by urban development and infrastructures; but also considerably spoiling of the social and cultural environment. At the same time, emerging economic development patterns that are largely designed for mass tourism put in question the stability of the economic profile of the region by exposing it to risks inherent to high vulnerability of this sector with respect to a wide variety of external to the area factors; and placing a remarkable stress on local resources (e.g. water, energy) but also infrastructures (transport, waste management, etc.) that is, furthermore, highly defined by tourism seasonality.

Another quite crucial challenge for the Mediterranean, as various studies reveal, is *climate change*. Extreme weather episodes are increasing in frequency and intensity worldwide; while the impacts of climate change affect all three pillars of sustainability, i.e. environmental, social and economic pillar, with Mediterranean region being one of the most vulnerable regions to global warming (ARLEM 2011). Indeed in IPCC (2007) it is stated that the rise in average temperatures in Europe will be greater than in the rest of the world, affecting winter period in northern Europe and *summer period in southern parts of the European continent*. In agreement to this statement is UNWTO and UNEP study stating that "*... the largest warming is likely to be in northern Europe in winter and the Mediterranean area in summer*" (UNWTO and UNEP 2008: 68).

As a result, the Mediterranean part will be affected also in respect of precipitation patterns, experiencing a significant drop in the number of rainy days in most of the Mediterranean regions, thus resulting in increased *risk of drought*. Although uncertainty and difficulty in getting reliable climate models at the regional level is inherent, it is clear that *water scarcity*, already experienced in the Mediterranean, will worsen, followed by extensive land *desertification*. Such a prospect is nowadays considered as one of the greatest challenges in the Mediterranean region, with

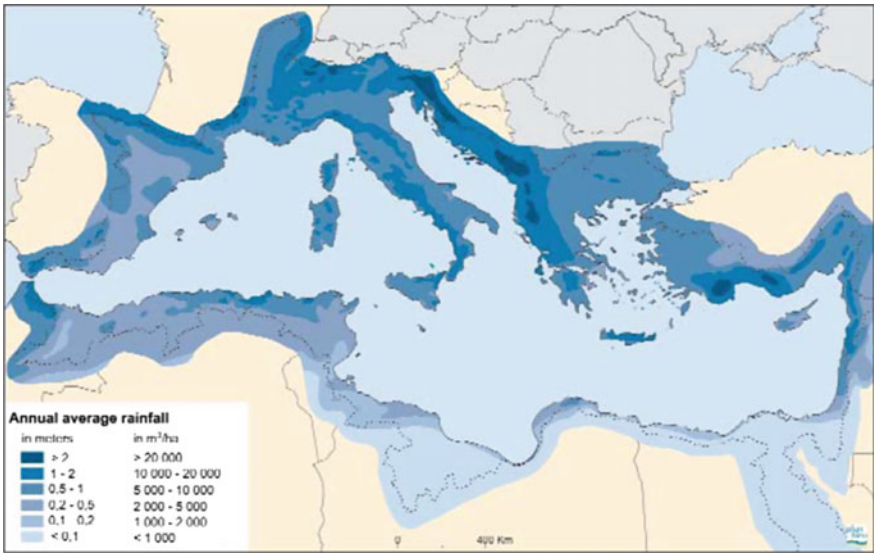

Fig. 7 Annual rainfall distribution in the Mediterranean. Reproduced from Margat (2008)

undoubtedly serious environmental, social, economic and political repercussions (IPCC 2007).

Due to climate change, the Mediterranean is already facing the reality of a water crisis in many of its areas, challenging sustainability objectives of these regions and livelihoods of their people, but also stability of their ecosystems. Considerable driving forces of this crisis are mainly: the increase in population and the accelerating urbanization rates; the heavy reliance on tourism but also on a water-intensive agricultural sector; and the climate variability and change, which have considerable impacts on precipitation levels and increasing drought frequency.

Scarcity of water resources is gradually gaining a dramatic importance, rendering the Mediterranean home of the 60% of the world's population that is classified as living in '*water poverty*' (less than 1000 m^3 of water available per capita per year) (GWP 2012). Since renewable freshwater resources (both surface and groundwater) are not uniformly spread over the Mediterranean region (see Fig. 7), with their current distribution favoring northern rim's countries, a large number of Mediterranean population (almost 20 million people), mostly inhabitants of rural areas in the southern and eastern part, have even no direct access to drinking water.

As noticed in GWP (2012), the most *water poor* Med-countries are Cyprus, Israel, Libya, Malta, the Palestinian Territories, and Tunisia, receiving all together less than 1% of the total freshwater resource of the Mediterranean region. Annual precipitation for example ranges from 1500 to 2000 mm in certain northern Mediterranean areas, such as the Alpine and Pyrenean regions, while in some southern Mediterranean countries these barely reach 100 mm, approximately 10% of the total precipitation (EEA and UNEP/MAP 2014). Calculation of

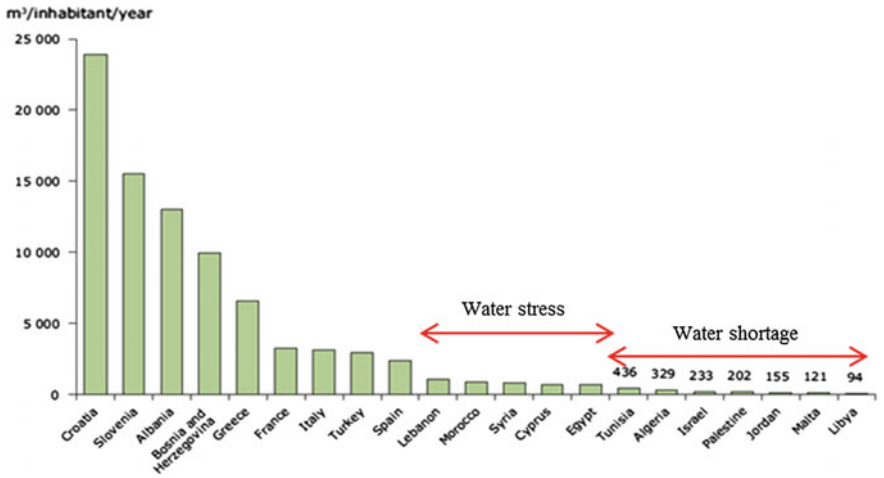

Fig. 8 Water resource availability (m^3) per inhabitant per year in Mediterranean countries. Reproduced from EEA and UNEP/MAP (2014)

Falkenmark 's (1989) *water stress indicator*, a measure for available water resources per capita per year, reveals that the majority of the southern and eastern coastal parts of the Mediterranean countries are in "*water stress*", with less than 1000 m^3/capita/year. Also in Mediterranean states like Algeria, Israel, Libya, Malta, Tunisia and the Gaza Strip, water stress indicator plummets to half—500 m^3/capita/year—a critical state that is characterized as "structural shortage" (GWP 2012), implying a severe *water shortage* situation (Fig. 8).

It should also be stressed the distortion of normal yearly precipitation patterns both intra- and inter-annually, as an outcome of climate change impacts that result to periods of severe drought, followed by episodes of torrential rain in the specific area (EEA and UNEP/MAP 2014), both with catastrophic results in all sustainability respects.

Low precipitation levels combined with high temperatures and respective high water evaporation rates, as consequences of climate change, lead to *water shortage* in the Mediterranean region, which is dramatically felt particularly in the southern MED-countries. The situation is exacerbated by the lack of a balanced water demand and supply regime, as a result of the development pattern followed (mass tourist development, agricultural development heavily relied on irrigation, etc.), where a high pressure is exerted on available water resources. Taking into consideration the climatic conditions and the duration of dry season, especially in southern MED-countries, as opposed to the seasonal shortages in northern Mediterranean countries, "annual drought" conditions are created in these areas (EMWIS 2007).

Water scarcity is further exacerbated by the rapidly evolving urbanization pattern, the specific policy choices as to mass tourist development in such regions (e.g. the 'mega-destinations' pattern) as well as the still highly dependent on irrigation

agricultural cultivation pattern. Coping with that vital for quality of life, health of ecosystems and biodiversity as well as economic development challenge implies an indispensable need for a more informed, sustainable and integrated management of water resources. This has to set up a *sustainable and smart water management system* that combines both *sustainable* (water policies, land use policies, sectoral policies, increasing awareness policies, education policies etc.) as well as *smart water management policies*, using smart technologies for a more effective and efficient water management and monitoring, ensuring that people's needs today, tomorrow and beyond are met.

Various studies on climate change impacts and vulnerability of regions as to this respect classify the Mediterranean region as one of the main climate change *hot-spots* (Giorgi 2006; ARLEM 2011). As such, it has already faced problems of water stress and extreme climate events, such as higher flood levels and more prolonged droughts, higher temperatures, rising sea level, more frequent storms, more frequent river floods, etc. As such studies claim, climate change will most probably exacerbate these problems, resulting in significant human and economic losses (EEA and UNEP/MAP 2014). More specifically, according to the International Panel on Climate Change—IPCC (2013), a temperature rise of 2–3 °C is expected in the Mediterranean region by 2050; and of 3–5 °C by 2100. Increasing temperature is likely to be accompanied by a further decrease in the level of precipitation, thus worsening water stress situation in this area.

Climate change impacts seem to be more pervasive in *coastal and island tourist destinations*, i.e. the majority of regions in the Mediterranean areas, taking the form of storms and extreme climatic events, coastal erosion, physical damage to infrastructures, sea level rise, flooding, water shortage and water contamination (UNWTO and UNEP 2008); while high *vulnerability* of these regions is often coupled with a low *adaptive capacity*, especially in developing countries (Stratigea and Katsoni 2015). The high vulnerability of *island regions* has also to be taken into consideration in the light of tourism's strong *seasonality* (mainly mass coastal tourism in peak summer periods), as in many island and coastal destinations the peak tourist season coincides with low water regimes in dry periods, aggravating thus water management and environmental issues (UNWTO and UNEP 2008). Indeed island regions, despite their low contribution to the greenhouse effect, they are exposed to high climate change risk. High climate change vulnerability coupled with low adaptive capacity seen in Mediterranean islands makes them one of the most susceptible to climate change areas of the world (Sauter et al. 2013). Main risks relate to higher temperatures, changed rainfall regimes, weather extremes, and sea level rise (Fig. 9), with evident impacts on their social, economic and environmental status.

As most of the coastal part of the Mediterranean is heavily depended on tourism, i.e. a highly *climate-sensitive* economic sector, climate change impacts are expected to largely influence this region. Indeed, climate change can affect all types of tourist activities and destinations, i.e. summer or winter tourist activities and respective coastal, small islands or mountainous tourist regions in the area, placing their position in the tourism market questionable. Changing climate and weather patterns

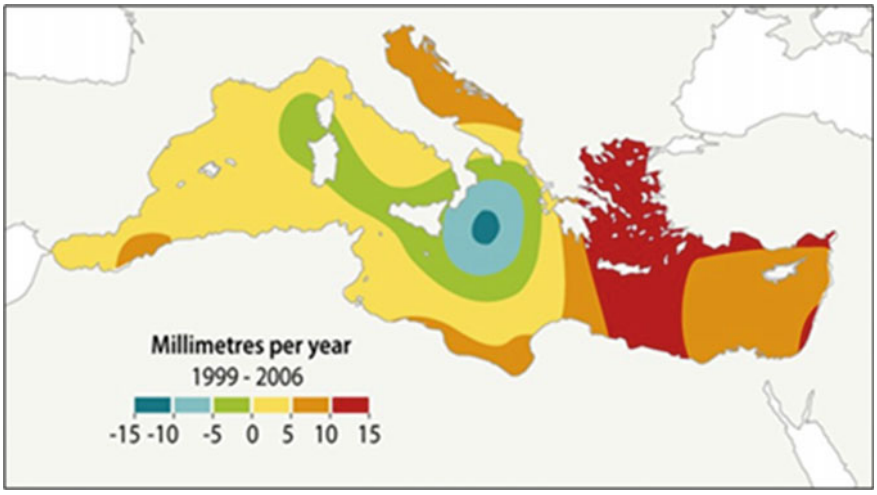

Fig. 9 Vulnerability of MED-islands due to sea level rise - Sea level variations 1999–2006. Reproduced from UNEP/MAP (2012)

in the Mediterranean will in the future be of decisive importance for the development of the tourist sector (UNWTO and UNEP 2008), as these may considerably affect tourists' comfort and thus travel decisions while, in extreme cases, they can even threaten travelers' safety, as past experience has shown (tsunami, floods, excessive heat, etc.) (Stratigea and Katsoni 2015).

As various researchers also notice, *migration due to climate change* will in the future largely affect migration movements from the southern to the northern parts of the Mediterranean area. Middle East and Africa climate change impacts, according to climatologists at the Strauss Center project on Climate Change and African Political Stability (Strauss Center 2016), Texas, have already affected weather patterns; and have contributed to an increased frequency of natural disasters (e.g. flooding, drought), placing survival of local population at risk due to the desertification of agricultural land and the severe impacts of heat waves on crops and animal grazing. Changing weather patterns favor migration to less climate change affected areas and urban centers, changing thus the geography of population distribution within countries and continents and favouring urbanization. A new class of migrants, the "*climate refugees*", is going to affect less exposed to climate extremes areas; and it seems that it will be a challenge for Europe of today and tomorrow, with yet unknown consequences.

A crucial issue for coping with challenges emerging in the Mediterranean has to do also with capabilities of *human resources*. In this respect, every single effort has to take into consideration the current *population mobility* in this region; and the quantitative and qualitative changes in population structure this entails. The Mediterranean area is on a great move in this respect, which may imply a transition

to a more critical, from the point of view of human resource potential and capabilities, state for dealing with MED hot spot issues. This is the outcome of two, of different in origin, very important in- and out-migration movements that are expected to affect Mediterranean regions in the years to come. The *out-migration movement* is related to the current severe economic crisis beating the northern rim of the Mediterranean (EU Mediterranean countries) that has allowed for pretty high unemployment rates and decrease of job opportunities; and the dramatic loss of valuable highly-qualified young people in these countries, known as the *brain drain* phenomenon. The *in-migration movement* on the other hand or better known as a *migrant tide or crisis* witnessed during the last years, which is actually testing the political and social structure and stability of Europe in many respects, is associated with the on-going political crisis in countries of the southern Mediterranean rim that causes mass movements to the northern MED-part with dramatic social, economic, political and environmental consequences. Strong migration patterns from south and eastern to northern Mediterranean regions, but also the resistance of many EU countries to serve as hosts counties of those migrants, leaves northern Mediterranean countries with severe multiple problems, but also a changing population structure that, apart from tensions, can eventually lead to a certain deficit in human resources capable of handling, in an effective and scientifically sound way, the future challenges and hot issues of the area. Destabilization of population pattern, taking place in both origin and destination Mediterranean countries, is a big issue for all MED states involved, the extent, the final outcome and the impacts of which are yet unknown.

4 Discussion

Intensively evolving urbanization trend in the global and European environment in general and the Mediterranean region in particular results in the overpopulation of urban environments. Such a trend is nowadays considered the "... *defining feature of the 21st century*" (Suzuki et al. 2010: xv); but also a great challenge ahead, questioning achievement of sustainability objectives of cities. The outcome of urbanization can be perceived both: *positively*, with urban areas being considered as the backbone of the European and Mediterranean economy and development, and places that can provide *solutions* to current environmental, social and economic challenges by boosting creativity and innovation; and *negatively*, with overcrowded urban areas being conceived as the *source* of contemporary challenges and risks, due to the excessive use of resources (e.g. energy, water, land), pollution, congestion, irrational consumption patterns, overproduction of waste, unemployment, segregation and poverty, migration, etc. (Stratigea et al. 2017).

In the shared vision of the European city of tomorrow, future cities are considered as (EU 2011: VI):

- places of advanced social progress, with a high degree of social cohesion, socially-balanced housing as well as social, health and education "for all" services;
- platforms for democracy, cultural dialogue and diversity;
- places of green, ecological or environmental regeneration; and
- places of attraction and an engine of economic growth;

or stated otherwise, cities represent a "*promise for the future*", built upon concepts such as freedom, innovation, creativity, opportunity and prosperity (Schaffers et al. 2012), seeking to fulfill sustainability objectives for future urban development.

The above vision is far from the present reality as well as the probable future, as this is predicted by past and current developments and trends in Europe but also in the Mediterranean area. Actually previously described aspects of this vision constitute "*targets*" to be reached within the general planning goal of *sustainable urban development* which, under the present circumstances, is acquiring an exceptional importance; and lies at the heart of policy makers at various decision-making levels.

Main issues raised for policy making in the Mediterranean context are (Stratigea 2012; Tao 2013; Stratigea and Panagiotopoulou 2015):

- The pace of *urbanization*, especially in the coastal parts that are highly threatened by climate change impacts and mono-sectoral (mass tourism) patterns of development in many coastal cities of the region;
- *Climate change* challenges that are highly threatening sustainability of Mediterranean urban and island ecosystems;
- *Demographic aspects* (growing and ageing population) and an evolving population *in-migration* (spatial concentration in urban environments, abandonment of rural land);
- Irrational *consumption patterns* and high rates of consumption of non-renewable resources (land, energy resources, etc.);
- Increasing *social cohesion problems*, which are expected to further deteriorate by an evolving migration crisis that is triggered by political instability, economic recession, wars, climate change impacts, etc. in many neighborhoods of the Mediterranean region (and not only in that).

The "*smart, sustainable and inclusive growth*" direction, lying at the core of Europe 2020 agenda, delineates distinct lines of policy action in pursuing urban socio-economic development in the third millennium. Such a direction places *sustainability* as the flagship or the ultimate goal to be reached by urban policy endeavors. Moreover it shows the "*means*" i.e. the radical technologies and their applications as the tools currently available in the hands of policy makers and planners in pursuing sustainability objectives; and the need to reassess sustainability strategies and render them more "smart" and thus more efficient and effective in the effort to plan, implement, manage and monitor sustainable urban futures. Finally, it delineates the "*approach*", i.e. the necessity for a more inclusive, cooperative and participatory perspective in decision making-processes in the urban context, taking into consideration all actors incorporated in each specific local ecosystem.

Added to the above directions is the one of *resilience*, i.e. the capability of Mediterranean cities to absorb *future shocks* to their social, economic, and technical systems and infrastructures, which are already visible in many parts of this valuable region.

At the heart of the Europe 2020 agenda lies, among others, the concept of *Smart Cities and Communities (SCC)* (EC 2012) that is recently evolving as a result of the radical technological advances and their applications; and constitutes a *new force* for effectively managing various urban functions in a highly connected, knowledge- and information-intensive era. Promoting smartness seems nowadays to be an effective and favorable, to many cities, strategy for steering economic competitiveness, environmental sustainability, and livability (Stratigea 2012; Lövehagen and Bondesson 2013; Stratigea and Panagiotopoulou 2014, 2015; Stratigea et al. 2017); and mitigating the impacts of urbanization trends and the consequent overpopulation of cities (Chourabi et al. 2012).

Further elaboration on the smart city (SC) concept brings to the fore its different interpretations, falling into two main streams namely: the *instrumental*, considering smart city as a set of ICT-enabled products, services and systems mostly pushed by technological advances and the market; and the *normative one*, visioning smart city as a strategy towards a desired outcome, where technology is used to further enhance sustainable policies by properly integrating city attributes/functions, and increasing their efficiency in the effort to pursue smart and sustainable development end states (Stratigea et al. 2017). To stress the importance of sustainability in the smart city context, the term *Smart Sustainable Cities (SSC)* has been conceptualized by the ITU-T Focus Group (ITU-T 2014), considered as a variant of SC, *a concept having at its core the goal of sustainability*, which additionally attempts to build upon the synergies created between the instrumental and the normative view.

Different city contexts have different sustainability target sets and related policy paths to fulfill them, largely dependent on their current achievements of sustainability objectives and strategic priorities, vision for the future and selection of relevant—socially and culturally driven—smart and sustainable policies, possible (based on available resources) pace of change, level of ICT infrastructure and readiness, etc. (Stratigea et al. 2017). Seeking to reach smart and sustainable cities' futures in the Mediterranean implies different policy paths for different types of cities. In this respect, there is a need to take advantage of new planning approaches and their implementation in decision-making processes for ending up with distinct policy decisions, relevant to those different Mediterranean city contexts. Such approaches should be (Stratigea 2015; Stratigea and Panagiotopoulou 2015; Stratigea et al. 2017):

- *Holistic and integrated*: taking into consideration functional and sectoral, but also different neighborhood realities of each Mediterranean city context and their interrelationships, thus moving away from *silos planning work*, being till recently a common planning practice.
- *City- and citizens-specific*: technology is not a panacea. The different attributes, problems, identities/cultures, priorities of sustainability objectives, technological

readiness, etc. have to be explored in order to identify the most relevant smart applications that will really add value to the cities' efforts to coping with great challenges ahead.

- *Vision-driven*: a certain vision should be there, as a desired—and inspiring—end state that will motivate cities' actors towards more responsible behavior and commitment; and will ensure successful implementation of plans developed.
- *Inclusive*: it is important to bring on board all relevant actors that can affect, be affected of or contribute to a certain decision; and create new forms of social learning, participation, responsibility and commitment. Multi-stakeholders' engagement is nowadays a prerequisite for increasing awareness, opening up a dialogue among all interested parties, and ending up with more elaborated decisions that are grounded on new values and consensus-building participatory processes.
- *Multi-level governance*: decisions at the city level are made within a certain decision environment that is most of the times framed by higher hierarchically decision-making bodies. In this respect, it is nowadays necessary to establish new models of governance that will assure: interaction and mutual understanding of different decision-making hierarchical structures; and flexible responses to complex problems through inter- and cross-disciplinary approaches, leading to more cohesive and well grounded decisions at each of these specific levels.
- *Foresight*: gathering intelligence as to the potential future developments in a variety of topics/sectors/trends is considered as an important step for identifying and getting prepared as to future discontinuities and challenges, which in turn can support more informed and knowledgeable decisions of today. In coping with complexity and uncertainty of Mediterranean territories' smart and sustainable development, but also developments in the global scenery that affect the future of Mediterranean cities and populations, foresight exercises could provide valuable information and knowledge by engaging different actors, associations, decision-making bodies, lay people etc.

Smart and sustainable city development does not follow a certain pattern and as Bhattacharya and Rathi (2015: 17) state, there is not only "*one size that fits all smart city models*". In fact, current smart city examples exhibit substantial variations in terms of technological maturity, level of ICT infrastructures and type of smart applications; that additionally are deployed for serving the needs of cities of varying spatial scales, sustainability objectives and current state of achievements; geographical and geo-political context in which smart applications are developed, etc. (Stratigea et al. 2017). This holds true for cities in the Mediterranean, where cities belonging to the northern or the southern-eastern rim are confronted with different, even contrasting sometimes, types of problems that need to be treated at the same time but in different ways. Strategies towards SSC need to be devised according to historical heritage, culture, local peculiarities as well as policy structures and practices; while committed, consistent and punctually planned implementation needs to be in place for a "*success story*" to be reached.

Smart Sustainable City (SSC) concept appears nowadays as a promising option and a strategy for coping with challenges ahead for cities in the Mediterranean region. It can also present a *win-win opportunity* for both: *the cities*, in paving smart and sustainable (SSC) city- and citizen-specific development paths; and the *ICT industry players* in grasping a really large market potential in the Mediterranean. Such a strategy, in order to fulfill its goal should:

- Place at its heart a range of smart applications that can effectively cope with main *challenges* faced by Mediterranean small and medium-sized cities and island communities as previously presented.
- Steer *green and blue* development perspectives by adding value or acting complementary to sustainability policies promoted at each specific urban environment.
- Support territorial, social and economic *cohesion* as key development pillars for a smart, sustainable and resilient future of Mediterranean cities.

Needless to say, effective deployment of relevant smart technologies and applications goes hand in hand with a *human-centric approach*, *reflecting and respecting cultural and historical paths* that have been sculpted out by Mediterraneans through the centuries in this exceptional part of the world, our "oikos[1]".

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[1]"Oikos" = Home.

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