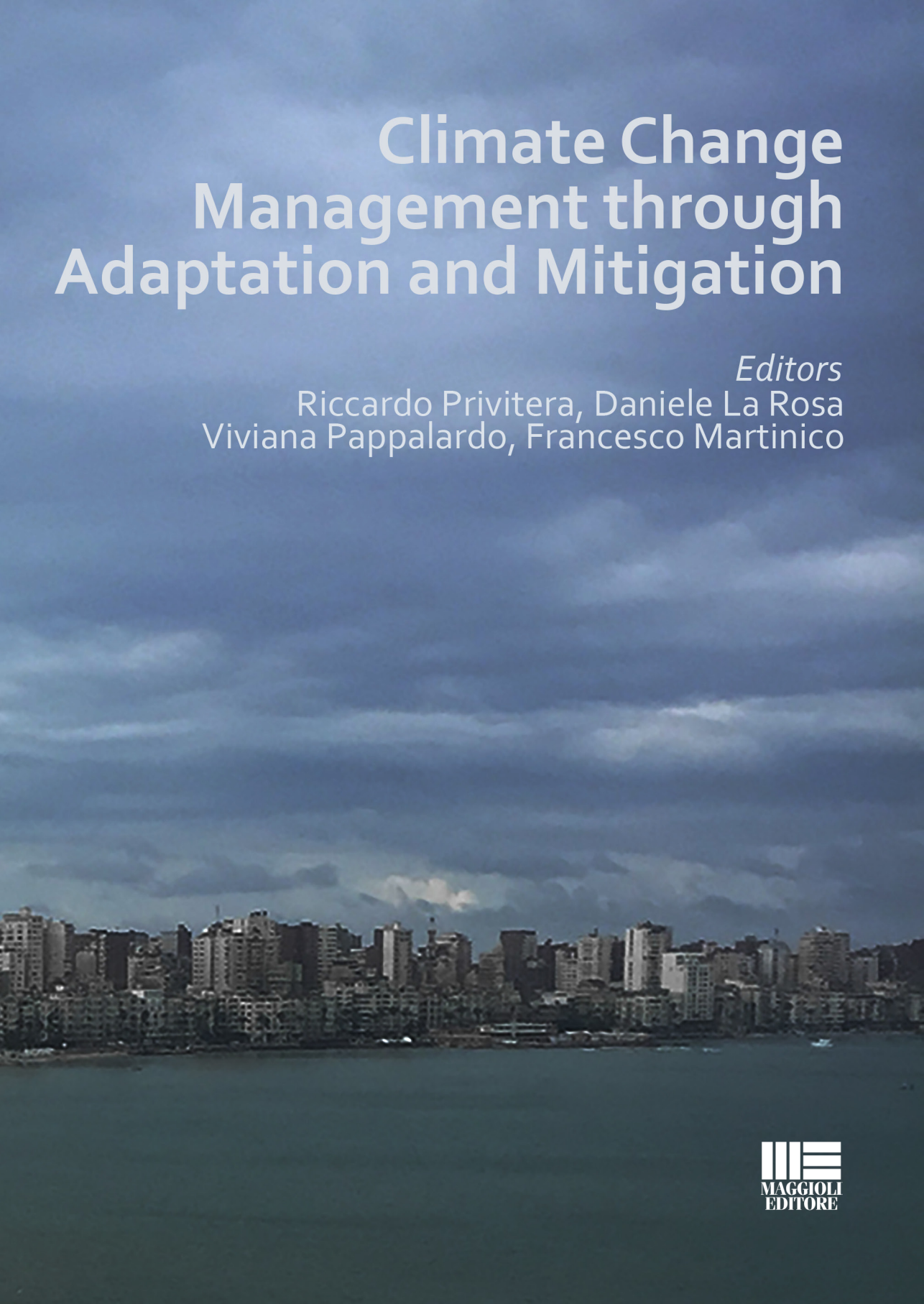
Climate Change Management through Adaptation and Mitigation

Editors
Riccardo Privitera, Daniele La Rosa
Viviana Pappalardo, Francesco Martinico



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Focusing on the major topics raised by the AdapTM Project, this book explores and conveys new insights into the state of the art of Climate Change management between the sea and the land. The contributions provide an extensive overview on adaptation and mitigation strategies and solutions across a wide range of urban and natural biotopes and regions and argue about the importance of tackling climate change issues for building a better and more sustainable future.
The book aims to emerge as a valuable contribution for enhancing knowledge and expertise of students, teachers, public administrations and other stakeholders interested in the management of climate-related issues, which are going to stress the area of Mediterranean with great strength. The building process of knowledge and awareness on climate change related issues is urgent and represents the only way to tackle the risks that our planet will face in the next challenging times.

ISBN 978-88-916-4307-0

Published by Maggioli Editore March 2021

Maggioli Editore is part of Maggioli S.p.A
ISO 9001 : 2015 Certified Company
47822 Santarcangelo di Romagna (RN) • Via del Carpino, 8
Tel. 0541/628111 • Fax 0541/622595

www.maggiolieditore.it

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Acknowledgement
This publication has been developed within the framework of the 'Climate Change Management through Adaptation and Mitigation - AdapTM' Project (Agreement number 2017-2965/001-001, Project reference number 585917-EPP-1-2017-1-IT-EPPKA2-CBHE-JP) financed by the European Commission - the Education, Audiovisual and Culture Executive Agency (EACEA), in the framework of the Erasmus + Programme and the Action KA2 - Capacity building in the field of Higher Education (CBHE).

Co-funded by the
Erasmus+ Programme
of the European Union

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Preface

Riccardo Privitera, Daniele La Rosa, Viviana Pappalardo, Francesco Martinico

About the Project

Climate Change Management through Adaptation and Mitigation (AdapTM) is a three year project (2017-2020, extended to July 2021 due to the Covid-19 pandemic) funded by the Education, Audiovisual and Culture Executive Agency (EACEA) of the European Commission, in the framework of the Erasmus + Programme (Action KA2 - Capacity building in the field of Higher Education). The network of Partners includes eight Higher Education Institutions from five different countries: University of Catania – Italy (Lead Partner), the Programme Partners of University of Klaipéda (Lithuania), Euro-Mediterranean University (Portroz, Slovenia), National Observatory Athens (Greece) and the Project Partners of Alexandria University (Alexandria, Egypt), Arab Academy for Science and Technology and Maritime Transport (Alexandria, Egypt), Suez Canal University (Ismailia, Egypt) and South Valley University (Qena, Egypt). The University of Catania acts as coordinator and leading partner of the Project, offering its contribution in the general management of the project, the scientific support for the development of customised curricula, the setting up of updated contents of the new courses for MSc, along with the organization of seminars and workshops for presentation of the curricula and the organization of local dissemination events, the development of didactic material and the organization of activities and lectures for an e-learning platform.

The AdapTM Project aims to continue the reform of the Higher Education system in the field of Environmental Sciences and to improve the quality and efficiency of educational process in Egypt according to the requirements of Bologna Declaration (1999) and Strategic Framework for European Cooperation in Education and Training (ET 2020). The main objective of the project was to ensure the design and implementation of an interdisciplinary Master Degree Study Programme in the field of climate change, in order to support Egyptian Universities with the integration of emerging technologies in climate change management in a competence-based education system, hence advancing higher education according to the European standards for quality of education. The eight partners have

been working on designing, accrediting and delivering the Master Degree 'Smart Environment and Climate Change Management (SECCM)' focused on Physical and Environmental Sciences and fully compliant with ET2020 and the Bologna Declaration.
Among the preliminary activities, the re-training of Egyptian Universities academic staff has been delivered for developing their teaching expertise and improving their ability on organise courses in climate change management with the integration of Information Technologies.
For supporting SECCM with innovative teaching materials, AdapTM network worked on conceptualising, editing and publishing newsletters, textbooks, mobile lectures, e&m-learning modules. With the objective to provide innovative learning methods, AdapTM network also implemented a Collaboration Platform (Google Suite) as learning and academic environment to share materials and information among scholars, lecturers and students and to establish their joint participation in the educational process and research. Last but not least, AdapTM consortium has been organising mobility of students and teachers between European and Egyptian Universities. European Universities academic staff have been travelling to Egypt for giving lectures within the SECCM Master Course modules whereas European students had a chance to attend selected modules taught by Egyptian academic staff. From Egypt, SECCM local students will be travelling to visit European Institutions (Covid19 restrictions permitting) for finalising their Master thesis. This on-going and in-coming International mobility (possibly to be replaced with online tailored lectures and activities in case of persisting pandemic) has been designed within AdapTM Project in order to maximise the opportunity to get a wider, deeper and effective educational and cultural experience.
The students and teachers mobility that has been already implemented, as well as the intense work for the master preparation and accreditation, was a valuable experience, useful to overcome organisational and cultural differences among the project partners. This can be considered one of key outcomes of the project.

About the Book
This Book focuses on the major topics raised from the AdapTM Project through exploring and conveying new insights into the state of the art of Climate Change management. The contributions provide an extensive overview on adaptation and mitigation strategies and solutions across a wide range of urban and natural biotopes (from urban coastal areas to marine environment and meteorology) and countries (from Lithuania to Egypt) and argue about the importance of tackling climate change issues for building a better and more sustainable future.
The Book is dived into three Topical Parts covering three thematic areas related to Climate Change management.

Part One ‘Cities and coastal areas’ comprises five chapters and provides a comprehensive knowledge on how mitigation and adaptation policies and strategies can be explored in urban core and coastal areas and integrated to urban planning practices.
The chapter ‘Avoid the unmanageable and manage the unavoidable. Cities between mitigation and adaptation to climate change’ outlines the idea of cities as an asset for carbon storage and sequestration through extensive and comprehensive urban afforestation an tree-plantation strategies. The transition to a climate-neutral society is both an urgent challenge and an opportunity to build a better future and this contribution re-states the crucial role of Urban Planning on managing this complexity. Keeping focused on urban planning as the most relevant among decision making processes for cities, the second Chapter ‘Sustainability and resilience of Mediterranean regions: urban policy and planning frameworks in Egypt’ discusses how international policy frameworks are informing the policy and urban planning strategic vision in Egypt, identified as one of the most critical tiles of the Mediterranean region mosaic, because of the difficult democratic transition and potential dramatic impacts on urban areas caused by the combination of population growth and climate-related risks. The focus on coastal areas is undertaken by the other three contributions that provide different perspectives of adaptation and mitigation to climate change at regional scale. ‘Natural and anthropogenic pressures in the Baltic Sea region’ argues about anthropogenic pressures induced by natural variability and human activity, such as coastal erosion, land cover change, and bio-invasions in the Baltic Sea region. ‘Risk Assessment of Climate Change on the Coastal area of Quseir, Red Sea, Egypt’ and ‘Adaptation of Sea-level Rise impacts in coastal areas due to Climate Change’ deal with the sea-level rise issues in Egyptian coastal areas. The former runs a risk and ecological effects characterisation by identifying as set of specific and related variables; the latter proposes a list of potential regulatory, spending, tax and market-based measures as well as comprehensive plans as a powerful tool by which local governments can guide development.
The ‘Marine environment and Maritime Industry’ are investigated in Part Two. This part collects five contributions that extensively deal with topics related to climate change effects on oceans, seas and related human activities. Relevant indicators (such as sea level, surface temperature, ice cover, wind wave regime, euphotic depth) are explored in ‘Indicators of Climate Change: Case of the Baltic Sea Region’ as a major instrument for investigating climate change and its impact on both the balance of the natural environment and marine ecosystems, as well as human socio-economic activities. Exploring in detail the oceans acidification and its biochemical cycles, the chapters ‘Climate Changes and Marine Microbes: Consequences and Adverse Impacts’ and ‘Biogeochemistry and Climate change’

provide a critical understanding about the implications of anthropogenic pollution on marine ecosystems and microbial community composition, the former proposing strategies such as physiological responses and evolutionary adaptation and the latter identifying climate engineering and blue carbon as the most promising to mitigate or reverse anthropogenic-induced climate change. Implications on Maritime Industry are then discussed within the two chapters 'Recent Sea Level and Tidal Characteristics in Alexandria Western Harbour, Egypt' and 'Legal Regime of Climate Change and Impact of International Maritime Transport Industry on Oceans and Marine Life'. The former, analyses sea level data inside the Alexandria western harbour (Egypt) in order to investigate the characteristics of tidal components and its potential effects on marine activities such as commercial shipping, marine construction, recreational boaters and even chart datum collections for nautical charts production. The second paper presents an overview of international frameworks, conventions and laws that relates oceans to climate in order to better understand how mitigation and adaptation measures should be improved and applied to set the maritime industry sector on a pathway compatible with the Paris Agreement and other Climate Change international relevant standards. Effective measures are needed to incentivise leading players and stakeholders of the international maritime industry to invest in low carbon and carbonless ships and operate the maritime industry in ways that reduce emissions.

Third part of the book 'Weather, Modelling and Monitoring' provides an important insight on the role of data collection and surveys, technological instruments, tools and advanced software for modelling, predicting environmental, weather and climate change and support mitigation of related risks and hazards. 'Weather-related hazards and community response in the Mediterranean region: the case of Greece' undertakes a study of the relationship between hazards and individual perception, while highlighting the need for a bottom-up approach to enhance the preparedness and adaptability of the citizens and achieve a more effective risk prevention in the country. The fundamental role of the mathematical-based approaches is highlighted in the chapter 'Climate in the Computer: Climate Change Mathematical Modeling' that widely argues about the different computing power and methods for modelling the Climate and proposes the Critical Breaking Point theory. Finally the potentialities of applying remote sensing and GIS for understanding and monitoring environmental changes (such as land-use/land cover, water resources, dynamics of sand dunes) are shown in 'Application of remote sensing and GIS in environment monitoring'.

This Book represents one of the most relevant deliverables of the AdapTM Project and has been designed to support and sustain its long-term durability while highlighting the fundamental role of a joint research and educational network of Mediterranean countries committed in climate change management. To this aim,

most of authors of contributions have been selected among the members of the AdapTM Project and other scholars who contributed to its implementation.
The book will go well beyond merely informing on scientific community and will try to reach a broader audience. It aims to emerge as a valuable contribution for enhancing knowledge and expertise of students, teachers, public administrations and other stakeholders interested in the management of climate-related issues, which are going to stress the area of Mediterranean with great strength. The building process of knowledge and awareness on climate change related issues cannot be postponed and represents the only way to tackle efficiently the risks that our planet will face in the next challenging times.

The Editors

PART ONE
Cities and coastal areas

2 Sustainability and resilience of Mediterranean regions: urban policy and planning frameworks in Egypt

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1. Introduction

After the Fifties, the Mediterranean regions started to host an unprecedented growth of cities, which formed one of the largest circle of urban agglomerations populated by millions of inhabitants (Chaline, 2001). In particular, the Middle Eastern and North African part is among the regions with the highest population growth (Malek and Verburg, 2017) and extremely vulnerable to expected climate change impacts (Frihy and El-Sayed, 2013). The Egyptian country represents one critical example in the southern Mediterranean foremost because is ranked as one of the fastest greenhouse gas growing emitters in the world and among the most vulnerable regions towards climate variability, water scarcity, loss of agriculture land and threats to food security, sea level rise and degradation of coastal resources (Abutaleb, 2018). The combination of population growth and climate-related risks challenges the difficult democratic transition and the sustainable economic growth. This is dramatically affecting metropolitan areas, which host the majority of a population that is expected to reach 130 million people by 2050 (Mirkin, 2010), with the prevalence of low income, poor educated and unhealthy communities (Attia, 2001). Particularly, the metropolitan areas of Cairo and Alexandria have historically attracted migrants from rural and poor developed villages, which have determined an unprecedented increase of congestion and pollution, informal development of slums, breakdown in urban services, loss of agricultural land and crises of food supply in the last three decades (Abdelaziz Attia, 2001).
On the global level the world confronts with multiple crises for global sustainability where cities represent the most fruitful place for rethinking approaches to disease and injury prevention (Grant et al., 2017), to recognition of inequalities in climate and environmental justice (Bulkeley et al., 2014; Wolch et al., 2014), to integrate smart urban technologies in planning the built environment (Graham,

2002). The sustainability policy agenda is continuously stressed in urban governance (Barnett and Parnell, 2016). At the same time, the concept of urban resilience has been widely explored in connection with policies related to risk assessment and management, adaptation and mitigation to climate change and general urban sustainability across developed and developing countries (McPhearson et al., 2018; Zhang and Li, 2018; Baravikova et al., 2020). Scientific literature abounds with definitions, frameworks, case studies and reviews which aim to codify tailored domains but it has become clear that policymakers, practitioners and academics continue to wrestle with the complexity of risk, resilience and sustainability, and the related necessary transdisciplinary focus (Becker, 2014). The apparently trivial clue of considering the concepts of risk and resilience as intrinsic of the idea of sustainable development may turn out to simply solve the above endeavour. So much so that, in the most recent update of the global sustainable development agenda (Transforming Our World: The 2030 Agenda for Sustainable Development), the United Nations (UN) adopted seventeen SDGs (2015-2030), that advocate 'inclusive, safe, resilient and sustainable' cities and human settlements for both developed and developing countries (SDG 11) based explicitly on targets directly related to risk assessment and management and resilience enhancement.

Urban planning is the most relevant among decision making processes for cities able to translate into practice most of the SDGs, and can lead to climate change adaptation and disaster risk reduction of urban systems (Borie et al., 2019). In the following sections, we discuss how international policy frameworks are informing the Egyptian policy and urban planning strategic vision. Particularly, we present a brief review of main policy and planning documents for the Egyptian context, analysing their relation with the different international policy frameworks and finally discussing the degree of integration and maturity.

2. Case study and methodology

2.1 The Egyptian urban contexts

Egypt is an highly populated country, with a growth rate of 2.3%. Most of the population is concentrated in only 4% of the country's land, leading to an average population density of 1435 people per km2 (Abutaleb, 2018). The unbalanced distribution of population among the regions and provinces of Egypt is unmistakable: while there are 219 cities in Egypt, Cairo and Alexandria alone contain about 43 percent of the total urban population (Hegazy, 2020). A large percentage of the population inhabit coastal cities, and potential social tensions could arise, related

to lack of prospects, water and sanitation conditions in slums within such cities (United Nations 2010). Analyses of the sea level rise scenarios in the Alexandria Governorate, for example, indicates that, if no action is taken, up to an area of about 30% of the city will be lost due to inundation. Almost 2 million people will have to abandon their homeland; 195,000 jobs will be lost and an economic loss of over $3.5 Billion, are expected, over the next century (El-Raey,1999).

Processes of urban sprawl started at the beginning of 1970th decade and are still threatening the limited highly fertile land in Egypt (El Ghorab and Shalaby, 2016). This reduction in agriculture land will increase unemployment rates and the immigration to larger cities. As a consequence, the rapid population growth worsens the problem of urbanization and unemployment increase, with the limited possibility of developing new areas as desert reclamation projects have been of limited success (Abutaleb, 2018). The larger urban environments can become the setting for conflict, brought in from the rural areas (Maninger 2000). An example is Cairo, situated in one of the most fertile areas of Egypt, where the city growth intensifies a constant conflict between agricultural land use and possible improvements of living conditions in the city. (Abutaleb, 2018). Major urban areas are mostly deteriorated and characterized by old and destroyed buildings, small size building and land blots, high population densities, narrow and tortuous road networks causing major mobility issues (El Ghorab and Shalaby, 2016). Informal areas have arisen due to the absence of a general spatial planning, developed in contradiction to building laws and planning rules, as residents build houses on state-owned land or on privately-owned agricultural land without getting permission to build (Khalifa, 2011). Both deteriorated urban areas and slums lack of all types of facilities, basic services and infrastructure including water, electricity, schools, transport networks, resulting in deprived settlements with insufficient standard of living (World Bank, 2008).

Egyptian cities and large urban areas are associated with environmental pollution of air, soil and water, which emerges as a result of many factors, including concentration of population, economic, industrial and traffic activities in urban centres that increase emissions, inadequate sewage disposal and solid waste management systems (El Ghorab and Shalaby, 2016).

All the previous represent difficult challenge that should be faced, in developing large scale planning strategies as well as urban development plans, with creative policy and planning solutions to reduce the pressure on the exiting urban mass, cut down sprawl and go toward sustainable development (Hegazy, 2020).

2.2 The framework to review the Egyptian planning and policy documents

The review of policies and planning documents was performed in March, 2020 by means of a query in the ResearchGate database (to check the potential availability of scientific papers on the topic) and in the Google search engine to select relevant grey literature on the topic. In particular, the following combination of terms was used for the search in Google: ("mitigation" AND "adaptation" AND "planning" OR "policy" AND "Egypt"); ("sustainable cities" AND "Egypt"; "resilient cities" AND "Egypt"; "sustainable planning" AND "Egypt"; "Egyptian cities"; "planning" AND "climate change" AND "Egypt"). After the first screening of titles and abstracts, only papers and documents explicitly referring to policies and planning instruments were actually reviewed. Other documents concerning theoretical studies, conference presentations and research articles with generic reference to sustainability and urban resilience were discarded (Pappalardo and La Rosa, 2020). The performed screening has resulted in the collection of twenty documents in total, including reports, articles and studies whose contents have resulted in referring to, analysing and discussing the main documents issued by governmental bodies and officially representative of the Egyptian policy and planning stance (five out of twenty documents).

Aiming to focus on returning basic information on the Egyptian official policy and planning references and to discuss the main directions of current Egyptian policy and planning strategies, emerging priorities and perspectives for future urban actions, the five official planning and policy documents were further analysed at a more detailed level by applying the method illustrated in Fig. 1. It relies on three well known and acknowledged policy frameworks: Sendai Framework (SF) in column A; the SDGs in column B; City Resilience Framework (CRF) (2014) in column D. Column C includes the factors critical to the achievement of the CRF goals at the level of urban practices. These factors, in particular, are used to evaluate qualitatively the alignment of the five main Egyptian policy and planning documents with the 11th SDG targets, which are grouped in four corresponding classes (i to iV). Thus, the five documents were analysed searching for the references of each factor throughout the contents of each document.

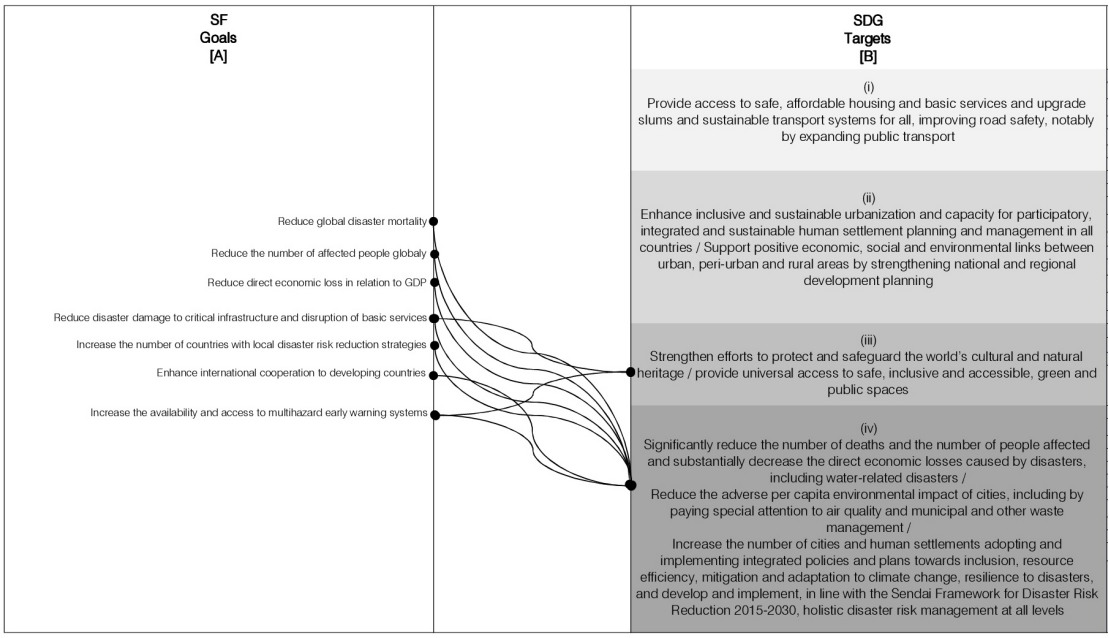
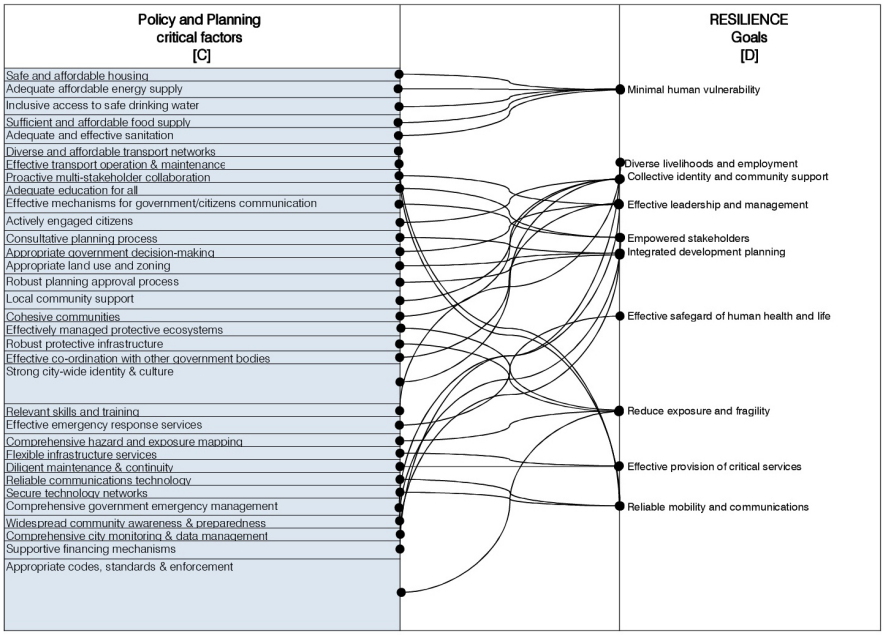


Figure 1. List of critical factors to be searched in the policy and planning documents review stage in order to evaluate the alignment with the SDS goal of making cities resilient and sustainable


Policy and Planning
critical factors
[C]
RESILIENCE
Goals
[D]
Safe and affordable housing
Adequate affordable energy supply
Inclusive access to safe drinking water
Sufficient and affordable food supply
Adequate and effective sanitation
Diverse and affordable transport networks
Effective transport operation & maintenance
Proactive multi-stakeholder collaboration
Adequate education for all
Effective mechanisms for government/citizens communication
Actively engaged citizens
Consultative planning process
Appropriate government decision-making
Appropriate land use and zoning
Robust planning approval process
Local community support
Cohesive communities
Effectively managed protective ecosystems
Robust protective infrastructure
Effective co-ordination with other government bodies
Strong city-wide identity & culture
Relevant skills and training
Effective emergency response services
Comprehensive hazard and exposure mapping
Flexible infrastructure services
Diligent maintenance & continuity
Reliable communications technology
Secure technology networks
Comprehensive government emergency management
Widespread community awareness & preparedness
Comprehensive city monitoring & data management
Supportive financing mechanisms
Appropriate codes, standards & enforcement
Minimal human vulnerability
Diverse livelihoods and employment
Collective identity and community support
Effective leadership and management
Empowered stakeholders
Integrated development planning
Effective safegard of human health and life
Reduce exposure and fragility
Effective provision of critical services
Reliable mobility and communications

3. Results

The focused official policy and planning documents are listed in the Table 1 that distinguishes policy-oriented contents developed at the global national level from strategic planning contents prepared at the regional scale. Results of the second-level analysis obtained from the application of the method in Fig.1 are commented thereafter in sub-sections 3.1-3.2, with the support of the Figure 2 and Figure 3. Both figures are created as radar charts to visually compare each policy and planning document against each class of SDG targets. Thus, they show the rate of each policy and planning document on several aspects that are widely considered fundamental to sustainability and resilience of urban settlements. In particular, the alignment value in each direction is obtained as the ratio between the number of references of critical factors counted in the text and the total number of critical factors corresponding to the group of SDG targets. Therefore, this value ranges between 0, when no alignment with the group is observed, and 1, when the alignment is complete.

National Policies	Sustainable Development Strategy – Egypt's vision 2030
	National Strategy for Disaster Risk Reduction (NSDRR 2030)
	The National Adaptation Strategy (to Climate Change and Disaster Risk Reduction) (NASCC)
	Green Pyramid Rating System (GPRS)
Strategic and regional planning	Strategic National plan for urban development (SNPUD-2052): – Strategic Plan for Greater Cairo Region 2052 – Strategic Urban Plan for Alexandria 2032

Table 1. Main official policy and planning documents on sustainable urban development in Egypt

3.1 National Policies

Out of a general consciousness of climate change impacts and potential consequences of unsustainable urban development models, Egypt has provided the international community with proofs of its efforts in addressing the global complex sustainability challenges.

The "Sustainable Development Strategy – Egypt's vision 2030" represents the top ambitious attempt to guide the development of Egypt towards sustainability and social justice. It is a complex, multilevel and multisector plan of intents, explicitly inspired by the United Nations 2030 Agenda. The strategy should be considered as an integrated general policy framework, based on certain major pillars with regard to the basic obstacles facing Egyptian society.

The urban development is included in those pillars underpinning the environmental dimension, and is expected to pursue a balanced management of land and resources to reform spatial development and improve urban liveability. Finding a quite good match for the critical factors targeted to the 11th SDG in the description of the Egyptian urban development programs to 2030 was effortless. However, the issues of affordable housing and provision of facilities as well as inefficiencies of planning and administrative local authorities are much more commonly recognized than urban risk management concerns, which are definitely less addressed by the same pillar. For example, security of urban areas is highlighted with regard to informal settlements phenomenon whilst climate-related risks and general impacts due to natural and anthropogenic hazards are discussed under different pillars such as the environmental one.

Actually, the separation of strategies and objectives according to thematic "pillars", which expressly refers to the conventional subdivision of sustainability in the economic, social and environmental dimensions, may culminate in missing a systemic vision and is likely to cause an underestimation of critical matters, especially for urban areas as complex systems.

On the whole, the main objectives to be achieved by Egyptian cities are related to urban growth and expansion. Accordingly, a range of indicators are proposed to measure cities' performances in terms of urban development, such as the rate of population settlement, the housing gap indicator, the urban area growth rate, the average localization of population in new urban communities proportional to population increase. Environmental issues are clearly and explicitly underlined focusing on the sole aspect of the achievement of green and sustainable building methods' spread. On the contrary, the factor of strengthening national and regional development planning and capacity for decision making is particularly noteworthy. In fact, the reformation of the institutional infrastructure and the enhancement in governance of the urban development planning and management system is the first programmatic point and is followed by the activation of municipalities' role in execution and management of urban plans.

The Fig. 2a shows simultaneously the more pronounced alignment of the document contents with the first two classes of SDG targets, if considering the section dealing with the urban development, and the overall isotropic consistency, if considering the totality of sections of the policy framework.

Yet in 2011, the "National Adaptation Strategy to Climate Change and Disaster Risk Reduction" (NASCC) dealt with climate change induced risks and disasters and their impacts on different sectors and activities, presenting several recommendations in the fields of housing, buildings, and roads, tourism, water resource management and agriculture. Clear reference is made to the usefulness of directing city planning and architectural design towards the requirements of a green and

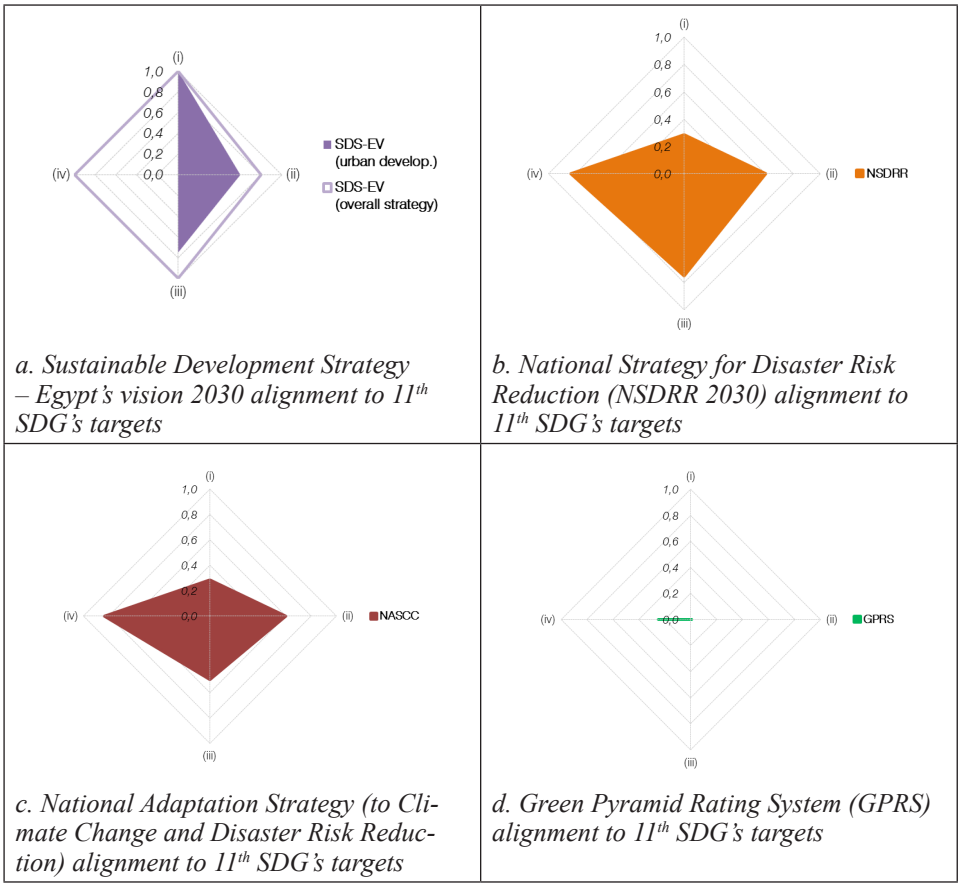
sustainable paradigm. Recommendations cover the efficient utilization of energy, rationalization of water use, issuance of a green architecture code, adoption of an energy code for residential and commercial buildings, environmental compatibility of buildings, promotion of climate change teaching in the academic programs (Pappalardo and La Rosa, 2020). It recommends integrating sector specific adaptation plans with national development programmes; enhancing community participation and building a 'Safety First' culture; promoting regional and international co-operation; and engaging in continuous monitoring of progress.

The NASCC can be considered a comprehensive policy that partially aligns with the SDGs overall framework according to the different targets considered in turn (Fig.2c). Not surprisingly, the last target, which is related to a holistic disaster risk management at all levels in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, was already well conceived in Egypt some time in advance. On the contrary, it is quite surprising the high representativeness of participatory processes enhancement, which foremost depends on the proposal for large scale campaigns for education, acknowledgment of political will at all levels as determinant and proactive multi-stakeholders collaboration.

Very recently, Egypt has completed the review and update of the National Strategy for Disaster Risk Reduction (NSDRR), that implements the Sendai Framework and considers achievements and future aims planned within the Egyptian Sustainable Development Strategy "Egypt's vision 2030". In fact, incorporating the concept of disaster risk reduction into sustainable development policies is highlighted as the first objective of the NSDRR 2030. Many policy and planning critical factors for making the human settlements resilient and sustainable are mentioned throughout the document. As better pointed up in Fig.2b, the principal aspects that are stress are related to: the development and implementation of a holistic disaster risk management at all levels; the reduction of the number of deaths and people affected; the direct economic losses caused by disasters. Similarly, the incorporation of investments as priorities for the protection of natural reserves, coastlines and agricultural lands and the protection of museums, monuments and places of historical value, goes in the direction of strengthening efforts to protect and safeguard the world’s cultural and natural heritage. Moreover, building partnerships with the civil society and the private sector is pursued as an activity of major importance to raise awareness on disaster risk reduction.

The Egyptian government has also proven a novel interest in promoting green buildings as part of its policy leanings on sustainable development. Three building energy codes were introduced in Egypt between 2005 and 2010, introducing mandatory energy performance requirements respectively for residential, commercial, and governmental buildings (Hanna, 2015). The energy efficiency codes were the first steps towards the development of the “Green Pyramids Rating System”. It was approved by the Egyptian Green Building Council and specifically addressed

to satisfy energy efficiency and environmental conservation urgencies as well as to allow innovative solutions and designs in the building sector. The methodology employed in the GPRS system is a point weighting system divided per categories. To earn a Pyramid Certification a project has to fulfil all the mandatory minimum requirements and may obtain credit points by meeting certain criteria in terms of water and energy efficiency, indoor environmental quality, usage of materials and resources, accessibility and ecological characteristics of the building site and so on. The GPRS policy expresses the Egyptian efforts in allocating some support to the construction and retrofitting of sustainable, resilient and resource-efficient buildings, providing appropriate codes and standards, working on community awareness and on city monitoring. As a result, the Fig. 2d illustrates the contribution offered by the policy reference to critical factors for the last class of SDG targets.



a. Sustainable Development Strategy – Egypt's vision 2030 alignment to 11th SDG's targets

b. National Strategy for Disaster Risk Reduction (NSDRR 2030) alignment to 11th SDG's targets

c. National Adaptation Strategy (to Climate Change and Disaster Risk Reduction) alignment to 11th SDG's targets

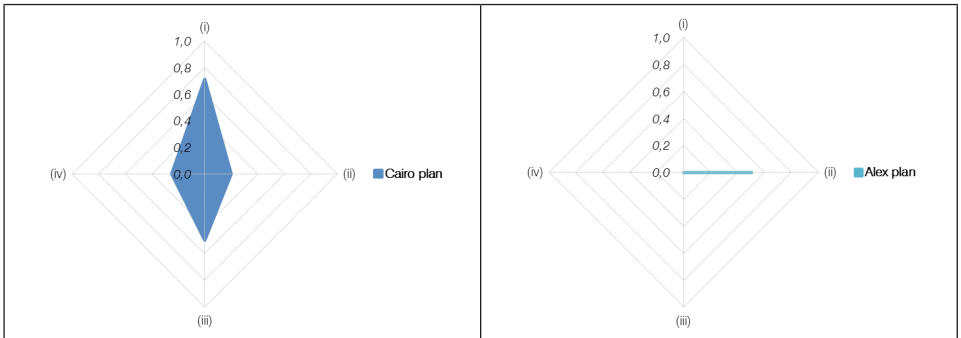
d. Green Pyramid Rating System (GPRS) alignment to 11th SDG's targets

Figure 2. Alignment of national polices with the 11 SDG targets

3.2 Strategic regional planning

Strategic planning was introduced in Egypt around the 2000s and officially adopted by the planning authorities in 2006 (Serag, 2018). The General Organization for Physical Planning (GOPP) is the main specialized body responsible for all spatial planning activities in the country under the authority of the Ministry of Housing and Public Utilities and is involved in organizing the planning process at all levels (regional, urban and detailed, from of existing to developing urban settlements) (Shaalan, 2016). It is asked to execute an agenda addressed to institutional transformations and developed the Strategic National Plan for Urban Development (SNPUD-2052), approved in 2013 (Arab Republic of Egypt, 2016). This strategic Plan constitutes the main reference document expressing the vision for current and future development of Egyptian human settlements, much related with the hope for a desirable fulfilment of the local communities' needs, enhancement of the built environment and improvement of the stagnant situation generally characterizing many Egyptian settlements.
The SNPUD strategy is focused on a paradigm of sped-up development with extensive programs of housing for resettlement of citizens, regeneration of slums, building development axes along the coasts of the Mediterranean, the Red Sea and the Gulfs of Suez and Aqaba.
Regional plans are presented as the chief tools to mitigate the urbanization pressure on the more congested cities, such as Cairo and Alexandria, levering the migration trends from most deprived areas, such as those of Upper Egypt, which could attract investments, expand and progress in turn.
Repeatedly all through the document, the principle of sustainable development is quoted but not precisely articulated, resulting in an utterance of rhetoric.
Sustainable pillars are more clearly encompassed within the Strategic Plan for Greater Cairo Region and the Strategic Urban Plan for Alexandria, for which it was however difficult to source some information regarding spatial development projections.
GOPP is preparing the strategic plan "Cairo 2052" and the strategic plan "Alexandria 2032", to achieve development and respond to the challenges facing the major metropolitan cities. It is also preparing strategic plans for 130 cities of the 231 Egyptian cities, the general strategic plans for 4409 villages out of 4673 Egyptian villages and development plans for 15 new cities (Arab Republic of Egypt, 2016). However, no official documents, maps, guidelines or other materials referring to the above planning outcomes are available to date.
The vision underlying the Strategic Plan for Greater Cairo Region has been built on eight key elements among which "Improve environmental conditions and achieve sustainability". This main target has been structured in sustainable pillars. As represented in Fig. 3a, critical factors to sustainable targets such as the provision of equal access to safe, affordable housing and basic services and the upgrade of slums are explicitly taken into account whilst determinants for coping with ur-

ban risk issues and disaster impacts are not well focused. Mainly, special attention is directed to air quality enhancement by means of targeted public transportation policies and development of new infrastructure networks, but actions addressed to comprehensive effective emergency response services, diligent maintenance and continuity of infrastructure functioning or widespread community awareness and preparedness are not expressly considered. In particular, improving the standard of living, the ability to enjoy an appropriate residence and to have a better quality of life is linked to supply deprived areas with facilities and basic urban services, including health care and education. Better environmental sustainability is addressed through the approval of environmental legislations and regulations, upgrading of public transportation focusing on strengthening mass and public transit, the development of potentials and capabilities of solid wastes management, the increase of reliance on renewable energy and the increment of green areas. The preservation of historical and archaeological areas is very much related to tourism expansion.
Similarly, to the case of the Cairo plan, also for the Strategic Urban Plan for Alexandria all information gathered are essentially indirect and make difficult to analyse in details the general vision for the metropolitan development as well as of the detailed actions programmes. Moreover, the Plan for Alexandria is not yet fully developed nor implemented.
From the review documents and research articles, it is known that the strategy is being designed as a physical plan, a participatory process, and the result of a consensus-building and a capacity-building tool to improve the capabilities of the local administration in urban development (Barthel et al., 2019). The Fig.3b is thus limited in portraying the alignment of the strategic plan with the objective of making Alexandria inclusive, safe, resilient and sustainable. It could barely report the firm will to adopt an effective participatory approach (Sirry, 2018).



a. Strategic Plan for Greater Cairo Region 2052 | *b. Strategic Urban Plan for Alexandria 2032*

Figure 3. Alignment of strategic and regional planning with the 11 SDG targets

4. Concluding remarks

It must be highlighted that the review method is subject to some limits: the use of English keywords only, the selection of policy and planning critical factors to meet SDG targets and the use of databases that are potentially very unlikely to include scientific references to the kind of documents of interest, returns research results which cannot be consider exhaustive of the entire Egyptian context. However, focusing on Egypt and its newly development strategies, this study could serve as a basis for starting the discussion about the policy and planning current stance on the challenges awaiting urban sustainability in part of the South Mediterranean context. In this regard, the transition of Egypt towards sustainability and resilience is definitely boasted at the strategic and programmatic level whilst validation on the level of local policies and urban practices is still at early stages and should not to be taken for granted.

Since sustainability and resilience have become a refrain around which multiple but differing interpretations have been fostered by specific agendas and associated priorities (Borie et al., 2019), important conflicts may arise among stakeholders, especially at the stage of translating into action such concepts.

Particularly, since the enactment of the strategic planning approach in Egypt, several aspects are being questioned in relation to its implementation. For example, in terms of vision, the transition from the strategic plan to detailed plans and projects is usually affected by the personal interests of some of the stakeholders, with the risk of seeing neglected in the final stage the original strategic vision. With regard to finalization, the plan making process always undergoes substantial delay and most analyses performed at the beginning become obsolete at the moment of plan implementation. Finally, public participation seems to be only fake whilst the opinion of the wider public and needs of citizens find rooms for expression when it is too late (Serag, 2018).

Plans, although good on paper, have been never really fully implemented or not implemented at all (Serag, 2018). Furthermore, also the gap between theoretical systems and corresponding practical systems, increases the problem of deterioration in all life systems of built environments (Hegazy, 2020), mainly because policies have emphasized the physical aspects of development without addressing the actual liveability of the urban environment.

These barriers to an effective implementation of policies and strategic planning for sustainability and resilience may depend upon complex and interrelated reasons: the instability of the political context, proper identification of interested stakeholders and their effective consultation against monopoly in decision-making, the administrative, fiscal, and political centralization, lack of funding and conflict when it comes to land ownerships, widespread corruption (Serag, 2018; Kenawy and Shaw, 2014; Nada, 2014).

Further research is thus necessary to investigate and monitor the capacity of Egypt to equip urban areas against natural and man-made risks and to prioritize tailored actions

addressed to improve the quality of life both in mega cities and minor villages as well as steer the growth of new urban settlements based on correct models of development. Indeed, in light of recent socio-economic developments and expected climate change impacts, the goodness and success of policy and planning implementation processes should be extended including other south Mediterranean developing countries, recognizing that lots of regions where new agglomerations are growing, are no longer capable to absorb an increasing population without compromising their natural resources and deteriorating the urban and rural environments. Despite similar needs and problems characterizing most Mediterranean cities, their order of priority and implications vary considerably between the Northern cities and the Southern and Eastern ones (Chaline, 2001). The degree of readiness and willingness to practise urban sustainability through relevant policies and planning tools at national, regional and local level is uneven and cities of Mediterranean exhibits numerous and important imbalances deserving additional attention of policy makers, researchers and practitioners.

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