Abstract - Modern management of Industrial Areas (IAs) can give an important contribution to Sustainable Consumption and Production (SCP) policy in Mediterranean regions. It includes activities related to environmental performance and sustainability, as well as marketing and promotion of the image of the Area and can allow to identify and exploit synergies among the settled companies to improve the overall efficiency in the use of natural resources of the area. Modern management is nevertheless a complex duty which comprises several tasks and requires a remarkable expertise in several fields. To help managers in performing these new tasks, a Mediterranean model, based on several project experiences realized at European and national level has been developed. The management model consists in a series of necessary steps to be followed to progress towards a more sustainable production system. To increase its effectiveness the model has been integrated with a set of web-based tools developed in some European projects which address several aspects of IAs management: a checklist with a scoring system for evaluating and benchmarking at international level the initial status of an IAs; a database of best practices which can be adopted in Mediterranean IAs for improving their environmental, social and economic profile; a guide for designing and constructing eco-efficient industrial buildings; a software for calculating the carbon footprint of waste management in IAs; a checklist for logistic services to identify and to provide a set of practical steps that can be taken to successfully accomplish a sustainable logistic service.

In this paper, after outlining some characteristic of the production system of Mediterranean region and the weak points of the actual SCP policies, the tools developed for supporting a modern management of IAs are described and their contribution to SCP policies are discussed. Some suggestion for improving the national and local policies in Mediterranean area are then discussed in the conclusions.

1. Introduction
In several Mediterranean regions, Industrial Areas (IAs) have been considered till recent years simply a place in which confine firms trying to hide and forget the unpleasant aspects of industrial production. These areas are often endowed with the infrastructures needed to comply with the emission limits provided by law and the only aspect which is managed is the settlement of the firms. More recently, it has been understood that IAs are a fundamental element of territorial development, as they can promote growth, jobs and entrepreneurship. If suitably managed and equipped, they can provide the opportunity to optimize the use of non-renewable energy resources and increase the efficiency of the use of raw materials by identifying and exploiting environmental, economic and social synergies among the settled firms [1]. In particular, thanks to many European
initiatives and projects, such as SIAM [2], MEID [3] and Ecomark [4], sustainable management of IAs is becoming one of the key elements to foster eco-innovation in the Mediterranean area, playing a significant contribution to Sustainable Consumption and Production (SCP) policy implementation, a European modern field of interest. Involving researchers and experts, development agencies, businesses, enterprises and IAs, local, national and transnational authorities as well as consumers, main aim of the SCP policy is to integrate environmental sustainability along with economic growth and welfare, to achieve an energy and resource-efficient economy.

SCP policy consists in “the use of services and related products, which respond to basic needs and bring a better quality of life while minimizing the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the life cycle of the service or product so as not to jeopardize the needs of further generations” [5]. Mitigating the environmental effects of human activities has traditionally focused on minimizing the effects of individual goods and services through technical product improvements. The SCP approach goes one step further: it looks holistically at systems of production and consumption and explores how these systems can be changed to reduce their overall environmental impact. It recognizes the influence of consumer demand on the consumption process, and therefore its potential as a policy area that can be addressed to minimize environmental effects. For this reason, this approach has become more and more relevant in the pathway to a Green Economy [6].

In this context, modern IA management should comprise several tasks and should require a remarkable expertise in several fields. These ones are related to environment and sustainability, as well as marketing and promotion of the image of the Area, are innovative and challenging, requiring a strong involvement of both Local Authorities and settled enterprises, especially SMEs, along with the essential IA Managing Company. The awareness that a systemic approach, extended over a whole IA, can ensure a more efficient use of resources, combining the needs of the companies and improving their economic performance, has been concretely developing in the past decade at the international level, also thanks to the development of environmental management tools extended to wider contexts, such as Local Authorities and industrial districts territories. In view of these considerations, one of the keys of the success of this structure is the creation of cooperative networks among enterprises and stakeholders, which could allow for identification of environmental, economic and social synergies [7-9]. Gibbs, especially, emphasizes the importance of networking and collaboration among the co-located firms as a key factor for long-term eco-industrial development, stating that “it is this networking activity that will potentially encourage materials interchange in the long-term and distinguish eco-industrial development from other, more superficial initiatives for the greening of industry” [9] (p. 1148).

Networking, also, helps in overcoming the problem of the small dimensions of SMEs, real giant of European economy [10], typical structure of Mediterranean IAs [11] and main obstacle to their environmental and innovation investments. At European level, Mediterranean region included, in fact, a widespread problem in adopting SCP practices is the lack of significant support systems for enterprises, mainly for SMEs, besides in general for IAs. In particular, there is a general lack of financial and economic incentives, together with an overall lack of administrative simplification strategies and regulation relief [10]. There is also a common lack of integration among different environmental and research policies in business activities, along with a general lack of knowledge of how to spread SCP approach among enterprises and Local Authorities. All these settings
represent a strong barrier for IAs managers and enterprises of MED regions to undertake the path towards sustainability. With this background, to help in overcoming those hitches and to support the development of SCP initiatives and eco-innovation practices in IAs, a new approach has been developed in the framework of ECO-SCP-MED project [12]. Co-founded by MED capitalisation Programme, ECO-SCP-MED it is a 18-month project which aim at ensuring sustainability across the supply chain of the main products and services in MED area, with attention also to sustainable management of IAs.

2. Method
ECO-SCP-MED project aims at creating tools to promote SCP in the Mediterranean area through the integration of tools and methodologies implemented in different MED projects. Its major objective is the creation of synergies among projects and partners and the building of a network of network in order to disseminate and transfer the results and outputs, integrating experiences and recommendations. In this context a working group (WG) coordinated by the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), has been organized to coordinate the work in the focus area of sustainable management of IAs. Aim of the WG has been to develop a toolkit to foster eco-innovative management of industrial areas, identifying synergies among the different outputs of previous projects conducted by partners, integrating them to make the project outputs more operational and giving in this way to users an added value.

The WG defined the main characteristics of Sustainable Industrial Areas toolkit, including its added value, the way to use it, the training needs, the actors to which the toolkit is addressed and the foreseen weaknesses. Finally the toolkit related to Sustainable Industrial Areas has been presented in an international workshop to expert of the sector to be discussed, gather suggestions and validate it.

3. Results
As introduced, modern management of IAs can give an important contribution to SCP policy and to eco-innovation development, helping the settled firms to face the increased environmental requirements of European legislation by fostering and exploiting synergies among the resident companies and helping managers to identify new marketing opportunities to make the area more competitive. To support the evolution towards an innovative IA management system a set of outputs of different projects have been integrated in an operational toolkit.

Cornerstone of the toolkit is a management model, called Mediterranean Eco Industrial Development (MEID) model, made up a series of necessary steps to be followed in order to implement sustainable management of Mediterranean IAs. The Model procedure systematizes several project experiences which have been realized at a European and local level, taking into consideration the specificities of the MED area. Since IAs of the Mediterranean have different levels of management and, most of all, have heterogeneous management, three different paths have been detected and should be followed according to the starting point of each IA [13]:
- Path 1: Planning and design of a new Industrial Area;
- Path 2:– Towards MEID Model in non-structured Industrial Areas;
- Path 3: MEID Model in structured Industrial Area.
The essential elements which have to be present and implemented at the end of the Path 3 are shown in Figure 2.

The framework created by the MEID model is essential to guarantee cohesion among companies and to provide a unique interface with Local Authorities and stakeholders, supporting the settled SMEs to improve their resource efficiency and competitiveness. In particular, the MEID model approach has contributed to identify and exploit synergies at IA level, promoting a shared industrial development policy, common infrastructures and innovative services. Figure 3 shows the key concept and elements of a sustainable IA according to MEID approach [14]. Besides, the management framework given by MEID model has shown the necessary system perspective of the structured practice.

![Figure 2 - MEID model](image)

![Figure 3 - Key concepts and elements of a sustainable IAs](image)
To increase its effectiveness and to improve its implementation, the model has been integrated with a set of web-based tools developed in some European projects which address several joint aspects of IAs management:

- a check-list with a scoring system to (self) evaluate the status of an IA with regard to its most relevant aspects. The checklist is based on 13 yes/no questions divided in five main areas, considered the most relevant for IA management: management, infrastructures and centralized services, energy/environmental quality of industrial buildings, animation/participation, green marketing/external communication. According to the answer, at each question is given a score which depends by the relative importance of the related area. The scores are then summed up to have a unique score of the IA. The weighting system is based on a qualitative expert judgment and has been built on the experience gathered in several European projects as MEID, Ecomark and SIAM - Sustainable Industrial Area Model. To increase its widespread usability, the tool has been developed on excel program;

- a web database of best practices which can be adopted in MED IAs for improving their environmental, social and economic profile. It includes environmental, social and economic solutions referred to centralized established infrastructures as well as innovative services in IAs of the Mediterranean Region. To develop this tool the database of MEID project, almost 150 examples of best practices related to about 50 IAs of MEID partner countries, has been integrated with the content of Ecomark project, about 30 added IAs;

- a guide to support the different agents involved in the process of design, construction and maintenance of Eco-efficient Sustainable Industrial Buildings to evaluate and improve their environmental and energy performances. It consists in 88 good practices related to the entire building lifecycle. Each measure is scored and weighted according to the relative importance of the area of action (e.g.: material, energy, waste, ecosystem, …). The weighting system allows to reach a unique score for the entire building;

- a software for calculating the carbon footprint of waste management in IAs. It is an adaptation of CO2ZW® software of Zero Waste project [15], an excel based software created for municipality waste, to IAs context. It allows to calculate the greenhouse gas emissions (in carbon dioxide equivalents) from the management of the waste fraction of IAs assimilated to urban waste. The output can be used as a guide for driving local government policy in the context of waste sector operations;

- a check-list to present to IA managers, Local Authorities, general stakeholders (Development Agencies, businesses promoters) the steps and the phases for carrying out an innovative sustainable logistics service which includes the planning, organisation, management, execution and control of freight transport operations also by integrating information, transport, inventory, warehousing, materials handling, packaging and even security activities. It is based on the Ecomark project activities, in particular on two operative tools: software for routes and one for loads optimization.

4. Discussion
Before to develop the toolkit, a gap analysis of the focus area on Sustainable Industrial Areas has been performed. It emerged that there is a general lack of local, national and transnational policies to improve the management of industrial areas. Legislation concerning IAs, despite the common
background of the European Directives, is quite different in the countries studied in the MEID project (Italy, France, Spain, Greece, Malta, Bosnia Erzegovina) and the approach to sustainability is even more heterogeneous. It should be mentioned that despite a law defines an IA in all the countries, a specific law concerning Sustainable Industrial Areas is only present in Italy. Here the concept has been introduced by Bassanini law (decree law 112/98) which delegates to the Regions the detailed regulation on the Ecologically Equipped Industrial Areas (in Italian Aree Produttive Ecologicamente Attrezzate, APEA) but still, it gives some basic reference elements such as quality infrastructures and systems and unitary management of the infrastructures and services.

Another interesting approach which has some valuable applicative experience on the environmental side is the “EMAS APO” (Ambito Produttivo Omogeneo, Homogeneous Production Areas) registration. It is ruled by a technical document of the Italian Ecolabel-Ecoaudit Committee which has the objective to promote the environmental improvement not only at a firm level but also at territorial level.

In France there can be mentioned the national initiative named “Grenelle de l’Environment” which was organized in order to take long-term decisions regarding environmental issues and sustainable development, to restore biodiversity and other related issues.

Any effort to make clearer the contribution that IA management can give to European policies (such as SCP policy) is therefore positive. The toolkit has been developed having in mind Industrial Area managers which wants to improve the efficiency of their area as main users. By using the toolkit they will be able to understand and evaluate the initial status of their area, to develop specific operational paths to improve the IA performance, to access an extensive database of operational good practices and to know how to contact the related organizations, to understand how to minimize the greenhouse gas emissions from the waste management of the area and to solve specific problems such industrial building efficiency and logistic.

Nevertheless, several target users have been considered in developing the toolkit (Fig 4).

In particular, Local Authorities can gather suggestions on the policies to set up for reaching a low-carbon economy, an efficient management of IAs and sustainable productive activities. Besides, they can act as facilitators for the development of sustainable IAs by adopting administrative and regulation relief, along with financial incentives. By a careful examination of needs and a consequently accurate IA policy, IAs can seriously consider the transition to sustainable ones, with
benefits for all. SMEs can understand the benefit in settling in well-managed IAs, in sharing services and infrastructures and in gathering indications on how to improve the efficiency of their industrial buildings. Service providers (e.g., energy, waste, water management companies) and general stakeholders (e.g., Development Agencies and Businesses Promoters) can understand how to give more value to their services.

To avoid an excessive complexity, the different tools of the toolkit can be used independently as they are focused on different aspects of Industrial areas management. It is suggested anyway to start with the management model of the area which gives a correct framework for more specific actions.

With regard to the added value of the toolkit, it could allow to solve some problems encountered by IA managers which want to improve their resource efficiency and market attractiveness and competitiveness, as, e.g., the lack of:

- a system perspective in managing environmental issues;
- a single source of information, examples of good practices, case studies on sustainable IAs;
- an internationally accepted model in managing IAs to which to refer and to propose to Local Authorities;
- tools for scoring IAs and measure the progress towards resource efficiency and sustainability.

To use the toolkit a general understanding of the principles of Eco-industrial parks and innovative industrial area management, the use of common infrastructures and innovative services, elements of Environmental and Energy Management Systems is required.

Some specific tools requires an in-depth technical knowledge:

- the use of “Guide to design eco-efficient industrial buildings” requires an engineering degree or similar technical knowledge on building design and construction, and a general comprehension o the energy and resource efficient design of buildings;
- the software for calculating the greenhouse gas (GHG) emissions requires a general knowledge on the waste treatment routes and processes, on the environmental problems caused by waste management and a detailed knowledge about the quantity, mereology and treatment routes of the municipal solid waste of the IA;
- the checklist “Innovative service guidelines” requires a general knowledge of sustainable logistics related issues and, furthermore, to carry out an in-depth analysis of the local context. In case the target users decide to develop also the Broker service it is necessary to get a specific training about the software to be used.

Finally it should not be overlooked the MEID management model capability to contributing to create a cooperative climate among the resident firms which helps to identify synergies at Area level. This approach can help enterprises to face the increasing challenges of the European legislation, exploiting the opportunities of Green Economy that, in the recent years of economic crisis, stood out as one of the few sectors that can achieve high growth rate when most of the others have negative trends [15]. Moreover, a common understanding of the enterprises needs and the development of cooperation attitudes push for the creation of networks which increase the SMEs possibilities to compete on international markets.

Innovative IAs, moreover, have been confirmed as the most favorable contest to implement and test the principles and tools of Industrial Ecology due to the possibility not only of sharing infrastructures and services for increasing the production and minimizing costs, but also reducing
environmental impacts caused by the industries concentration and aggregating the demand and transfer of technological innovation related to environmental, energy and water resources.

5. Conclusions and outlook

The toolkit described in the paper has been developed in order to support the sustainable management of IAs. It can help many actors, mainly IA managers and settled firms to achieve environmental and economic benefits, implementing eco-innovation activities with a cooperative approach which can help in identifying and exploiting synergies among co-located firms.

In these first months since the toolkit completion, a promising interest has been shown by IAs managers and firms on the proposed approach. Anyway, an assessment of the direct impact of the use of Sustainable Industrial Areas toolkit has not yet been produced.

Europe has prepared the ground for the transition to a more “Resource Efficient” economic model of production and consumption and this is one of the 2020 flagship initiatives coordinating actions across many policy areas to secure sustainable growth and jobs through better use of resources [16].

However, specific political, social, economic and technological barriers to wider implementation and take-up still persist:

− companies often lack awareness, knowledge or capacity to pursue circular economy solutions;
− current systems, infrastructure, business models and technology can lock the economy in a linear model (“take, make, dispose”);
− investment in measures to improve efficiency, or innovative business models, remains insufficient as they are perceived as risky and complex;
− demand for sustainable products and services may remain low, in particular if they involve behavioral change;
− policy signals for the transition to a model of "circular economy" (reuse, repair, refurbish and recycle) are not sufficiently strong and consistent.

Industrial Areas have been demonstrated the more effective for implementing sustainable models of production and all the operational tools developed to this aim [17].

A real limitation of the potential impact of the toolkit is the reluctance of IAs managers to invest in improvement actions due to a common and widespread lack of incentives, and more in general of opportunities, to support IAs to improve their resource productivity and to help the adoption of SCP policies. Usually, if provided, the environmental incentives to firms concern in fact only the theme of energy consumption, efficiency and renewable sources and do not often cover other environmental aspects. The implementation of incentives, not only of economic nature, but also as administrative simplifications strategies, should help in overcoming this problem and in supporting the enterprise’s performances.

Another important barrier for mainstreaming this tool is a lack of integration among different European policies, such as among research policies and territorial cooperation ones and a general lack of knowledge on how to spread SCP approach among enterprises and Local Authorities. Therefore, the European projects should face these issues favoring the integration among the results of research, the innovation tools and business.

A lot of studies highlighted a greater interest in developing new on eco-design tools than on studying the use of the existing ones and to evaluate them for their improvement [18]. On the contrary, this work differs from other studies on eco-design tools and eco-innovative practices
because it is focused on identifying possible synergies among different tools. Its added value is
due to the integration of different outputs and tools of European-funded projects. Therefore, rather
than focusing on single solutions, new opportunities have been identified to promote SCP policy
implementation, valorizing synergies of existing tools applied together.
Finally, to really implement SCP initiatives and eco-innovation in IAs and, in general, to improve
sustainability of products and services and in production processes in MED area, we believe that
real case studies should be developed in order to test and assess the benefits for enterprises and
environment which foster the spreading of positive experiences.

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