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First outputs of the project QUADMAP: state of the art on Quiet Urban Areas management tech

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Abstract
The QUADMAP (QUiet Areas Definition and Management in Action Plans) project is offering the first results. QUADMAP is a LIFE + project.
A significant part of the first tasks of QUADMAP project is devoted to the analysis of the state of the art on Quiet Urban Areas management techniques in diverse European States. The outcome of the work dealing with these aspects is the subject of this paper, mainly in Spain and Portugal.

Keywords: quiet areas, soundscape, urban noise poilicy.

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1 Introduction to the QUADMAP project

QUADMAP is a LIFE + project, started in 2011 and its main objective is to develop a harmonized methodology for selection, assessment (combining quantitative and qualitative parameters) and management (noise mitigation, increasing of usability of areas and users satisfaction) of Quiet Urban Areas (QUAs), the aim being to overcome the current impasse.

The project is focused on the problem of Quiet in Urban Areas, where not only noise limits have to be considered and where noise is one of the sources of pollution causing discomfort. The validated eventual results of the project will facilitate urban planners to apply standard procedures for identification, delimitation and prioritization of QUAs.

The consortium of the project is formed by University of Florence (leaders), Florence municipality and Vienrose, from Italy; DCMR, from Neterhlands; Bruitparif, from France; and Bilbao municipality and Tecnalia, from Spain.

The main purpose of this communication is to present the conclusions of the state of art on Quiet Urban Areas management techniques for Spain and Portugal developing a brief comparison with other countries in the EU.

2 Building the State of the Art on QUA management techniques

A significant part of the first actions of QUADMAP project is devoted to the analysis of the state of the art on QUAs management techniques.

The primary research for doing the State of the Art consisted of the questionnaire, developed within the QUADMAP project. Exploratory, secondary research was conducted through analyzing governmental publications, published by the competent authorities of the respective countries and reports produced by experts and the EU Commission.

The following items were analyzed:

1) Methods for selecting/analyzing/managing QUAs:
   - where methods and applications have been looked for (national legislation, local agencies…),
   - existing definitions of QUAs,
   - description of QUAs selection methodologies,
   - description of QUAs analysis methodologies,
   - description of QUAs management methodologies,
   - strengths and weaknesses of analyzed methodologies.

2) State of the art about techniques for collection of citizens' opinion about QUAs: strengths and weaknesses of analyzed methodologies

The following countries were analyzed, separeted in EU areas:

- The Netherlands, Belgium, Norway and United Kingdom (in charge of DCMR)
- Italy and Germany (in charge of VIENROSE)
- Spain and Portugal (in charge of TECNALIA)
- France (in charge of BRUITPARIF)

3 Review of publications in Spain and Portugal

3.1 National legislation review

In the Portuguese case, there is a Law Decree 146/2006, 31 July, that defines quiet areas as:

> '*quiet area in an agglomeration*' an area, delimited by municipalities in documents that are part of the municipal land use planning, exposed to Lden $\leq$ 55 dB(A) and Ln $\leq$ 45 dB(A);
>
> '*quiet area in open country*' means an area, delimited by municipalities in documents that are part of the municipal land use planning, that is undisturbed by noise from traffic, industries and other economic activities, or recreational activities.

In the Spanish case: the Law 37 2003 and the Decree 1367/2007 define these concepts as:

> '*quiet area in agglomerations*': area where noise levels caused by environmental sources should be 5 dBA lower than the acoustic quality objective linked to the zone in which it is located (for instance: 60 dB in residential areas). The goal is to preserve in them the best acoustic quality. These areas should be stated and managed by Local Authorities.

'*quiet area in open country'*: spaces that are not disturbed by noise from traffic, from industrial activities or from recreational sports activities.

Both experiences in Spain and Portugal start from the need to transpose these concepts from the END to the national legislation. No specific information for its assessment and management are defined in these normative.

3.2 Scientific review

A desk study was carried on, reviewing the following databases to search works done by Spanish and/or Portuguese authors: SCOPUS, SCIENCE DIRECT and WEB OF KNOWLEDGE. The key words used are: Quiet areas, 2002/49 CE, Noise mapping, Action plans. Further, publications have been searched related to TECNIACUSTICA. The scientific literature review of previous research in those databases does not have very good results. The database query did not find any reference related to Spanish or Portuguese authors.

Moreover, information has been found on the internet in different specific journals as ADB AECOR, SEA ACUSTICA, etc.

For example, we can find information related to the 40th SPANISH CONGRESS ON ACOUSTICS 2009 (Iberian Encounter on Acoustics, Iberoamerican and European Symposium on Environmental Acoustics and Acoustical Sustainability Building) in which a methodological approach to the identification of quiet areas and natural sound reserve is presented (García Pérez et al., 2009). The conclusions drawn from the analysis show that the methodology used to identify areas is useful as a first approach, but it is necessary to incorporate additional indicators to the LAeq to perform an analysis which includes considerations related to soundscapes. In any case, the involvement of the authorities responsible for management of the area is needed to identify the quiet areas and to define the plans for preserving them. These plans must consider the maintenance and improvement of these areas, as a priority and it should integrate these considerations into others plans or programs.

In the same conference Patricio gives an overview of the implementation of Portuguese acoustics legislation in terms of its framework, environment protection, urbanizing procedures and building fundamental requirements, in accordance with sustainable development, socio-economic and buildings performance (Patricio, 2009). Also, the most relevant aspects dealt with are also described, concomitantly with the responsibilities addressed to municipalities, designers and all administrative entities involved in the legalization processes, following a perspective of sustainable development and an interrelation with technical innovative solutions. At last, taking into account the societal progress, the future environment safeguard and the quality of human living for future generation, some conclusive and prospective aspects are summarized.

Moreover, in the Acústica 2008 conference (20-22 October, Coimbra, Portugal University of Coimbra) Puig and Majo give an approach of how the Government of Catalonia will proceed in order to help and support the development of the action plans and specific plans in the noise zones, both at the municipal and supramunicipal level, and to develop tools to appraise the possible corrective actions, in aspects such as acoustic efficiency, technical complexity and/or costs associated to their implementation (Puig & Majo, 2008).

Finally, this internet review gives us information about the second phase of the Strategic Noise Maps. Their construction is regulated by Directive 2002/49/EC, of 25 June, on the assessment

and management of environmental noise, Decreto Lei nº 9/2007, Law 37/2003 (Ley 37/2003) 17 November, on Noise, and Royal Decree 1513/2005 (Real Decreto 1513/2005) 16 December, implementing Law 37/2003 (Ley 37/2003), in reference to the assessment and management of environmental noise. In accordance with these regulations, 64 Spanish agglomerations must develop its MER before June 30, 2012. Also for the same date, the directive requires approval MERs to major roads with traffic exceeding 3 million vehicles per year (representing 16,166 km of roads); to 1,342 km of major railways with more than 30,000 trains per year and at 13 major airports (more than 50,000 movements per year) (Frías & Merino, 2011). Strategic noise map is a tool designed to help assess overall exposure to noise in a given area due to the existence of different sources of noise, in order to diagnose the overall acoustic situation and detect quiet areas to be protected.

3.3 Review of the published answers to the Directive (END) commitments

As it is detailed in the EU Directive 2002/49/CE, in the Article 4, each Member State had designated competent authorities for the collection of noise maps and actions plans and must make the related information available for the European Commission.

This competent authority is the Ministerio de Agricultura, Alimentación y Medio Ambiente (with the support of CEDEX agency) in the case of Spain and the Agência Portuguesa do Ambiente in the case of Portugal (Ministério da Agricultura Mar Ambiente e Ordenamento do Território).

In connection with the process of making the information available, each authority has a web site with the information regarding Noise Maps and Action Plans, in Spain and Portugal:

- Spain: http://sicaweb.cedex.es/
- Portugal: http://www.apambiente.pt/_zdata/DAR/Ruido/SituacaoNacional/MapasRuidoMunicipais/MapasRuidoMunicipaisAdaptadosDL_9_2007_indicadores_Lden_Ln_UltimaVersao_2.pdf.

In these web sites the information regarding municipalities and regions Noise Mapping and Action Plan is available. In both cases the documents are connected to the Directive 2002/49/CE commitments for urban agglomerations (first phase of the implementation) with more than 250,000 inhabitants.

The agglomerations with documents in the web sites are the following:

Table 1: Agglomerations with information about Noise Mapping and Action Plan available in the web-site.

	Noise Mapping	Action Plan
Portugal*	Alcobaça, Alenquer, Alfândega da Fé, Aljezur Almeirim, Alpiarça, Alvaiázere, Arcos de Valdevez, Arruda dos Vinhos, Azambuja, Batalha, Benavente, Bombarral, Boticas, Cadaval, Caldas da Rainha, Carrazeda de Ansiães, Cartaxo, Chamusca, Chaves, Coimbra, Condeixa-a-Nova, Coruche, Covilhã, Esposende, Ferreira do Zêzere, Figueira da Foz, Freixo Espada Cinta, Golegã, Gondomar, Leiria, Lisboa, Lousa, Mafra, Maia, Macedo de Cavaleiros, Marco de Canaveses, Mirandela, Mogadouro, Montalegre, Ovar, Ourém, Palmela, Penedono, Pombal, Portalegre, Porto Mós, Póvoa Varzim, Resende, Ribeira de Pena, Rio Maior, Salvaterra de Magos, Santarém, Seixal, Sernancelhe, (Setúbal), Sobral de Monte Agraço, Terras de Bouro, Trofa, Torre Moncorvo, Valpaços, Vila do Conde, Vila Flor, Vila Franca Xira, Vila Nova de Gaia, Vila Pouca de Aguiar, (Vinhais)	---

Spain**	Alicante, Baix LLobregat I, Barcelonés I, Barcelonés II, Bilbao, Córdoba, Gijon, Granada, Las Palmas de Gran Canarias, Madrid, Málaga, Murcia, Palma de Mallorca, Pamplona, Santa Cruz de Tenerife-San Cristobal de La Laguna, Sevilla, Valencia, Valladolid, Vigo, Zaragoza	Barcelonés I, Bilbao, Pamplona, Madrid, Santa Cruz de Tenerife-San Cristóbal de La Laguna Valencia, Vigo y Zaragoza

* Portugal in its national legislation (Decreto-Lei n.º 9/2007) include other municipalities that must fulfil these documents.
** In the case of Spain, national legislation does not include more agglomerations appart form the detailed in the Directive. Nevertheless there are some regional normative that includes other municipalities in the noise mapping process. In this case the information is not available in the Ministerio de Agricultura, Alimentación y Médio Ambiente web site.

All the documents were analyses to identify if there is information regarding the UQA management.

- Information of the Noise Mapping documents in Portugal.
  There are no references to UQA management in the documents

- Information of the Noise Mapping and Action Planning documents in Spain.
  The information regarding UQA is summarised in the table of the following page (Table 1).

  As a special case, we can remark that Bilbao and Zaragoza municipalities have defined criteria to identify quiet areas. It is similar in both cases:
  - Having a surface that allows having an internal sound environment without remarkable environmental noise (sound from traffic or industries). The minimum area that should have these surfaces is estimated at about 50,000 m^2 in Bilbao and 90,000 m^2 in Zaragoza.
  - Being for public use and having public access.
  - Having a use or function that requires a tranquil sound environment: Green Areas of Bilbao and public spaces.
  - Being part of the municipal plans for preservation and improvement of acoustic quality. This variable depends on the acoustic analysis, but it is related to the municipal objectives, to the city design and to modification plans that exist in each area.

  Table 2: References to .QUAs management in the Noise Mapping and Action Plan Documents of Spanish cities.

City	***Objective***	***Actions***	***Definition***	***Identification***	***Deadlines***	***Budget***
Bilbao	Preserve QUAs	Not set	Areas intended for recreation or natural interest.	No	Long-term strategy	No
Pamplona	Preserve acoustically protected areas	Restrict noisy activities	Areas with reduced noise levels and pedestrian use and recreation uses	Yes	2.011-12	No
Madrid	Preserve UQAs	Restrict noisy activities Underground waste containers	Areas with noise levels L_{day} and $L_{evening}$ < 60 dBA	No	No	Yes, but not specifying
Tenerife - La Laguna and Canarias	Preserve UQAs and natural areas	Not set	Areas with noise levels L_{day} < 60 dBA	No	No	No
Valencia	Protect UQAs against an increase in levels	Not set		No	Long-term strategy	No
Vigo	Preserve UQAs	Not set	Areas used for recreation or cultural interest	No	No	No
Zaragoza	Declare 5 UQAs Define associated Action Plan	- Create/Maintain large parks or pedestrian spaces - Combined with traffic calming zones (areas 30). - Pedestrian corridors. - New urban design ideas.	Areas with sound quality and public use for leisure	Yes	2.011-16	No
Barcelones I	Protect UQAs	Not set		No	No	No
Murcia	Protect UQAs	Not set		No	No	No
Cordoba	Conservation of Urban Parks	Not set		No	No	No
Granada	Protect UQAs	Not set	Noise levels calculated and tested by 7d measurement	No	No	No
Sevilla	Protect UQAs	Restrictions to heavy traffic, at night.	Free of heavy traffic	No	No	No

4 Stakeholder questionnaire

Besides the scientific review and the analysis of the public information of the competent authorities for the collection of Noise Maps and Actions Plans in connection with the Directive commitments, questionnaires are sent to agglomerations involved in the two phases of the implementation of the Directive: with more than 100,000 inhabitants. We have consulted to 56 agglomerations. Also the Agéncia Portuguesa do Ambiente (Portugal) and the CEDEX (Spain) were consulted as the stakeholders that support the Official Government Department in each country for the collection of Noise Mapping and Action Plans of agglomerations to send them to the European Commission.

The questionnaire had been completed by: Barcelona and Oeiras municipalities, CEDEX and Agéncia Portuguesa do Ambiente. A summarize of the answers is presented in the following chapters. In some of the issues considered in the questionnaires, the paper also refers to outputs from the overall State of the Art developed by other QUADMAP partners in other countries.

In the following paragraphs the results of the questionnaires are presented including, in some cases, a comparative analysis with the information obtain in other European countries.

4.1 Concerning identification and characterisation of Quiet Areas:

What is, in your opinion, the definition of a quiet area?
In the case of the Portuguese Environment Agency the definition refereed is the one that is in the national legislation (that has been presented in the first part of this state of art for Spain and Portugal).
CEDEX and Oeiras highlight other more qualitative concepts:

- area with a soundscape that allows its use for resting and that must be protected, and
- area where noise doesn't reach levels as to cause discomfort. These areas are important to reduce general stress levels. They should be used for leisure activities.

Barcelona and San Sebastian remark the compliance of thresholds:

area in the city with sound levels below Lday 50 dBA and Lnight 45 dBA or only Ln<50 dBA

Which are its characteristics?
The reference to a noise threshold is common but, in the case of CEDEX, a reference to soundscape is included. Barcelona goes further and distinguishes between three types of UQAs:

- parks and gardens,
- courtyards and unique islands and
- some quiet section of urban roads.

How important are the "quiet areas" for the public and the environment?
UQA are considered important in a social and environmental level because they put natural systems near to urban areas and relieve the city. Its interest is specially remarked for high noise polluted urban environments.

Which is the principal use of these areas and who visit them?
In the case of Barcelona experience, the peri-urban quiet areas area visited by citizens of the different parts of the city, but in the case of UQA the citizens of the neighbours of the area visit them more frequently. The main function is, in general, relaxing and leisure activities.

Which indicators are used for defining and identifying quiet areas?
"Low overall noise levels" is the common indicator. In the case of CEDEX, connected to noise pollution and it is also needed to have a use for relaxing and resting. These indicators are linked, in Barcelona, with the regional and local normative.
The following figure compares the indicators used in different UE countries for QUAs

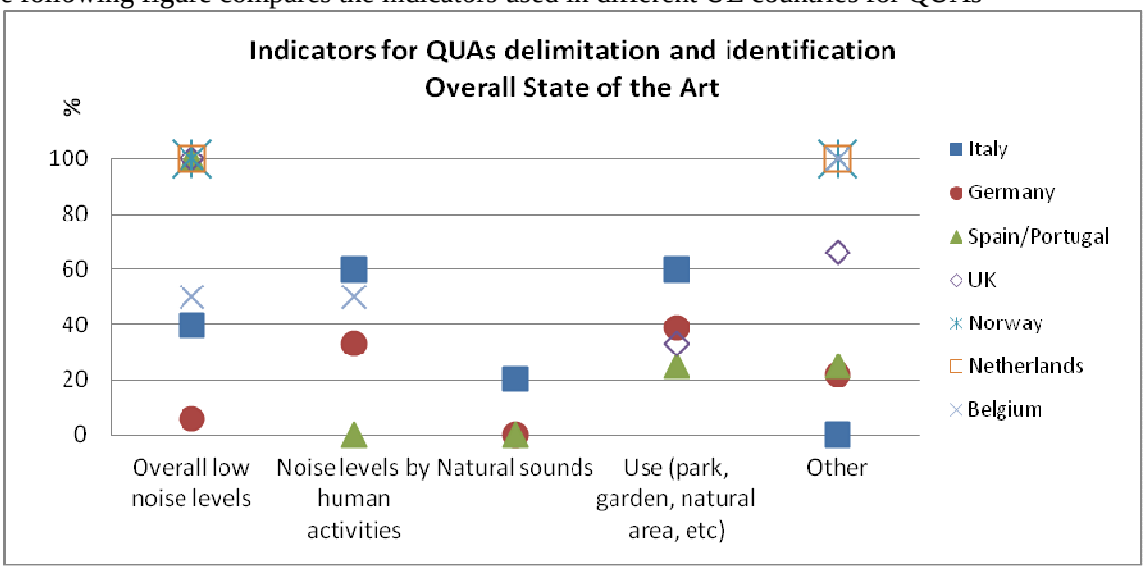

Figure 1: Acoustic Indicators for QUAs in Europe.

Other indicators (apart from the acoustical aspects):
CEDEX considers the frequency of visitors, the use and function and the accessibility as aspects to be considered. From Barcelona point of view the frequency of visitors and the presence of natural, cultural heritage elements and the landscape (aesthetic) are important factors. And Oeiras selected the reasons for the frequentation of people to the area as an additional indicator.

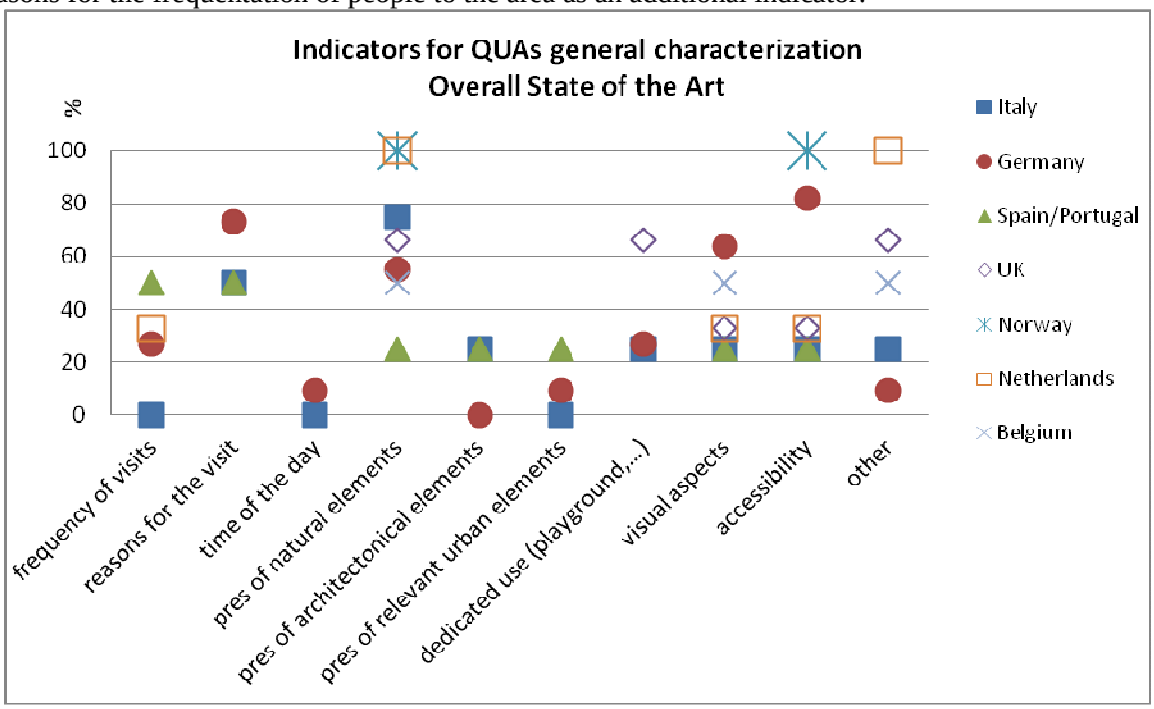

Figure 2: Other indicators for QUAs in Europe.

What are the indicators for the characterization of quiet areas related to environmental noise?
In some cases sound level measurement is part of the methodology but more in connection with their selection than with their analysis.

Barcelona, by the moment, just considers noise levels. Oeiras adds to them their variability in time. CEDEX includes also the identification of sound sources (and their relative contribution to the sound environment) and the quality of the soundscape (psychoacoustic parameters).

Bilbao developed a pilot case to define the methodology for analysing the quiet areas:

- Noise prediction tools were applied to identify areas that are exposed to less that L_{day}< 60 dBA.
- Some sound measurements were developed (of 15 minutes) to obtain L95-L5 as and indicator of the quietness of the area. The less the indicator is, the quieter the area is supposed to be.

This approach is considered as a first option which will include other aspects apart from the noise pollution for the identification and study of QUA´s.

Neither of them considers the perception approach (questionnaires) for the UQA assessment.

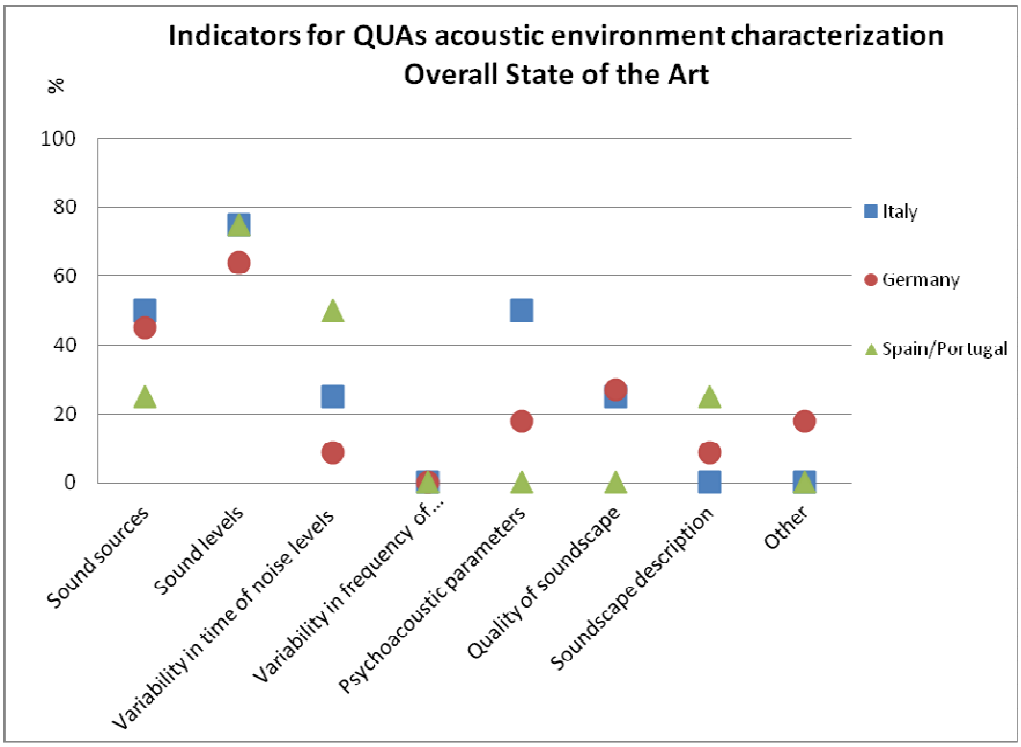

Figure 3: indicators for characterization of QUAs in Europe.

4.2 Description of QUAs management methodologies

Concerning Action Plan and Quiet Areas, Barcelona does have an Action Plan that includes UQA consideration and the actions defined are technical and physical ones. They are included in one of the 5 action lines of the Plan. Despite, Oeiras does not consider specifically Quiet Areas in its Action Plan.

These results should be considered in combination with the outputs of the analysis of the published official documents, shown in Table 1.

Concerning the Management of Quiet Areas:
No specific management experiences are reported, but some action plans detailed the connection of QUAs management process with urban design and Noise Action Plan.

Oeiras declares that there are no goals or targets on this matter. Therefore there is no action on management. In fact, it is said that it is not planned to consider Quiet Areas assessment in the second round of the 2002/49/EC Directive.

In the case of Barcelona, new UQAs will be probably defined in Barcelona in connection with the development of new urban areas and this concept will be taken into account in the second phase of the implementation of the END (with the same approach that was applied in the first one). It will include the monitoring process of the evolution of the areas, analysing the effectiveness of the actions applied.

The overall outputs of the state of the art made by other partners of QUADMAP, show that in general there are very few strategies for managing the QUAs. Nevertheless, there are good examples of procedures and methodologies in France and UK.

Concerning the relation of QUA management with other local policies, Barcelona link the UQA Management to noise policy, space policy, health policy, quality of life policy, nature policy, but there is not a procedure for monitoring the degree of compliance of the policy objectives.

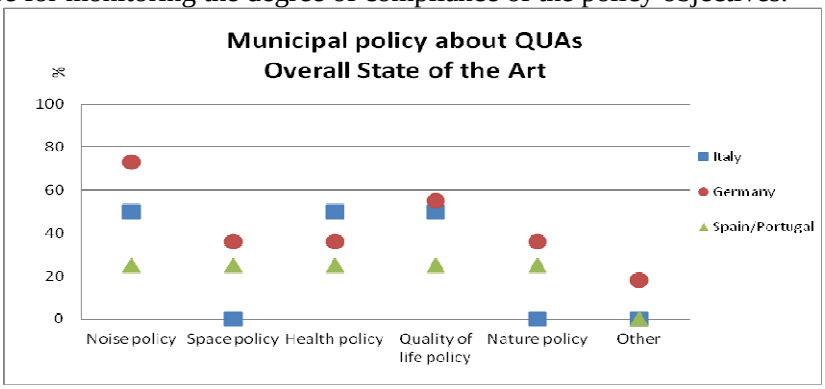

Figure 4: Municipal policy about QUAs in Europe.

Concerning Stakeholders involved in the management of Quiet Areas

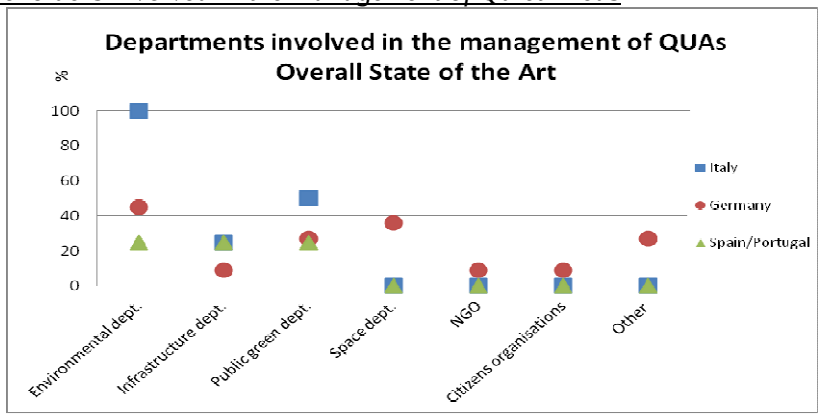

Figure 5: Departments involved in QUAs in Europe.

5 Strengths and weaknesses of analyzed methodologies

As a conclusion of this analysis, it can be said that in Spain and Portugal the methodologies to identify, select and analyze QUAs are mainly connected with the Strategic Noise Mapping process. This approach has some consequences:

- The main indicator is the fulfillment of a noise pollution threshold.
- The methodology is consistent and highly coincident in the most part of experiences
- Spanish agglomerations and administration have only 5 years experience on QUAs and the effort has been mainly focused in the identification process.
- The specific aspects about QUAs are postponed to the definition of Noise Action Plan.

On the other hand, the details of the concept of the QUA (that are needed for its appliance and management) are not defined yet, but some important issues that involve a definition of a QUA are shared:

- the interest of this areas for citizens quality of life,
- theirs connection with natural elements and aesthetic values, and
- the importance of their use and accessibility.

The final report of the State of the Art developed by the QUADMAP project will be published briefly. This paper shows the very first results focused on the situation on Spain and Portugal. There is also a very first general SWOT analysis of the outputs from the overall State of the Art developed by QUADMAP partners.

Table 3: Draft summary of the SWOT analysis made in the QUADMPA project.

Strengths	*Weaknesses*
• UK considers a broad range of aspects for QUAs • Several cities use quantitative AND qualitative criteria • Several cities apply criteria allowing relatively low noise levels (50-55 Lday) • Strong link with citizens quality of life, their connection with natural elements and aesthetic values, and usability and accessibility • Consultation of citizens and participative approach in some cities •	• Some cities allow relatively high noise levels (55, 65 dB Lday) • Some cities have criteria that are weak on safety and maintenance • Criteria are different among several cities: no unified vision of the problem • No particular interest or competence among local policy makers: problems are most felt at scientific and university level than at local and administrative level • Most cities do not have a procedure for monitoring the degree of compliance with policy objectives • In some cases only large areas (more than 30 ha) can be considered as quiet areas in Germany • Limited experience and consequently postponing of actions in Spain • Limited skills regarding surveying and other perception approaches at local level •

Opportunities	*Threats/Risks*
• All countries can add criteria from each other • Authorities can take a more user centred approach in surveys and public consultations	• Risk of not finding enough QUA for many quality demands • Risk of having discontent from different user groups as demands and perceptions are different • Time consuming or 'incorrect' approaches due to limited guidelines and harmonisation from either EU or national competent authorities

All the activities and results of the project will be available at the web http://www.quadmap.eu. There will be also place for interchanging opinions and experiences.

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