Evaluation of Directive 2002/49/EC Relating to the Assessment and Management of Environmental Noise

Final Report

The Centre for Strategy & Evaluation Services LLP
August – *2016*

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Luxembourg: Publications Office of the European Union, 2016

ISBN 978-92-79-61993-9
doi:10.2779/171432

EUROPEAN COMMISSION

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Directorate-General for Environment
Knowledge, Risks and Urban Environment

2016

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CONTENTS

GLOSSARY OF ABBREVIATIONS, TERMS AND DEFINITIONS

A glossary and definition of acronyms, abbreviations and technical terms is provided below:

Abbreviations and acronyms	Full wording
Art.	Article (in an EU legal text)
CBA	Cost-benefit assessment
CA / CAs	Competent Authority/ Competent Authorities
CDR	The Central Data Repository, the database set up by the EEA for the collation of END reporting on SNMs and NAPs. The CDR is based on shared information infrastructure accessible to Member States through the EEA's EIONET.
CNOSSOS-EU	Common Noise Assessment Methods in Europe. This is the methodology that was developed for the purpose of achieving a common approach to strategic noise mapping through the revision of Annex II and adoption of Commission Directive (EU) 2015/996.
DALYs	Disability-Adjusted Life Years
DF/ DFs	Data Flow(s) are the different EC databases developed drawing on END reporting data and information submitted by the EU MS are drawn up in different databases and reports known as DFs.
EC	European Commission
EIONET	European Environment Information and Observation Network, through which END reporting information in respect of SNMs and NAPs is collected.
ENDRM	END Reporting Mechanism (the mechanism developed for END reporting of data and information by the EU MS to the EC
ETC/ACM	European Topic Centre on Air Pollution and Climate Change Mitigation (assists the EC and EEA in reporting tasks).
END	The Environmental Noise Directive - Directive 2002/49/EC.
ERFs	Exposure-response functions
FTEs	Full-Time Equivalents
HA	Highly Annoyed
ICAO	International Civil Aviation Organization
JRC	Joint Research Centre
LV(s)	Limit Value(s)
MS	Member State
NAPs	Noise Action Plans
OPC	Open Public Consultation
Reportnet	The EEA's reporting mechanism which has been tailored to gather data and information on END implementation through the EIONET network of Member State authorities. See https://www.eionet.europa.eu/reportnet
SNMs	Strategic Noise Maps
VOLY	Value of Life Year
WHO	World Health Organisation
xml	Extensible Mark-up Language (relating to reporting through Reportnet)

Technical terms/ definitions	Description
Action Planning Body	An organisation nominated in the capacity of a Competent Authority responsible for producing a Noise Action Plan.
Agglomeration	'Agglomeration' shall mean part of a territory, delimited by the Member State ("MS"), having a population in excess of 100,000 persons and a population density such that the MS considers it to be an urbanised area. However, it should be noted that in R1, an agglomeration was an area with a population in excess of 250,000 persons as part of a transitional period.
Major airports	A civil airport with >50,000 movements per year (a movement being a take-off or a landing).
Major railway	'Major railway' shall mean a railway, designated by the MS, which has more than 30,000 train passages per year. Note: Major railways in R1 were defined as > 60,000 train passages per year and in R2, the threshold changed to > 30,000 train passages per year.
Major roads	'Major road' shall mean a regional, national or international road, designated by the MS, which has more than 3 million vehicle passages a year; Note - major roads in R1 were defined as a road with > 6 million vehicle passages a year. In R2, the threshold was changed to > 3 million vehicle passages a year.
NRA	National Road Authority
R1/ Round 1	The noise mapping which took place in 2007 and the subsequent adoption of Action Plans in 2008 onwards.
R2/ Round 2	The noise mapping which took place in 2012 and the subsequent adoption of Action Plans in 2013 onwards.
R3/ Round 3	The noise mapping that will take place in 2017 and the subsequent Action Plans that will be prepared in 2018. There will be a transition in some EU MS towards the use of the CNOSSOS-EU methodology (voluntary only).
R4 / Round 4	The noise mapping that will take place in 2022 and the subsequent action plans that will be prepared in 2023. The use of CNOSSOS-EU, as defined in the revised Annex II will be mandatory.
TFEU	Treaty for European Union, the Lisbon Treaty, adopted in December 2009.

A list of some of the acoustical and technical terms used in the report for the benefit of non-technical readers is provided below:

Technical term	Explanation/ description
A 'common approach'	The term 'a common approach' is used in the report as shorthand when referring to Art. 1(1) of the END whose full aim is to "define a common approach intended to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise".
Annoyance	One of the health endpoints mentioned in the current WHO guidelines for quantifying the burden of disease from environmental noise. The WHO defines annoyance as an emotional state connected to feelings of discomfort, anger, depression and helplessness.
Cardiovascular diseases	One of the health endpoints mentioned in the current WHO guidelines, includes minor changes in cardiovascular activity and myocardial infarction.
Competent Authority (CA)	The CA is an organisation designated as being responsible either for the development of Strategic Noise Map(s), Noise Action Plans or both.

Technical term	Explanation/ description
Disability-Adjusted Life Years (DALYs)	One DALY represents one lost year of "healthy" life. The sum of these DALYs across the population, or the burden of disease, can be thought of as a measurement of the gap between current health status and an ideal health situation.
Dose-effect relationships	The END describes this as meaning "the relationship between the value of a noise indicator and a harmful effect". This also describes the change in effect on exposed population caused by differing levels of exposure (or doses) to noise (measured in dBs) after a certain exposure time.
Health endpoints	Examples of health endpoints mentioned in the current WHO guidelines are: annoyance, sleep disturbance and cardiovascular diseases.
Sleep disturbance	Sleep disturbance is a further health endpoint mentioned in the current WHO guidelines, includes EEG awakening, motility, changes in duration of various stages of sleep, sleep fragmentation, waking etc.
Noise metrics	*There are two key indicators that are used in implementing the END, L_{den} and L_{night}. Definitions of these terms are provided below:*
L_{den}	'L_{den}' (day-evening-night noise indicator) shall mean the noise indicator for overall annoyance, as further defined in Annex I of the END.
L_{night}	'L_{night}' (night-time noise indicator) shall mean the noise indicator for sleep disturbance, as further defined in Annex I of the Directive;
TSIs	Technical Standards for Interoperability – voluntary standards in the rail sector.
VOLY	A Value of a Life Year is a concept used in the CBA relating to the monetisation of the health benefits associated with reducing high levels of environmental noise.

This is the final report of the study led by the Centre for Strategy & Evaluation Services (CSES) and ACCON supported by a further acoustics and environmental consultancy, AECOM.

Authorial team

The lead authorial team was comprised of the following team members:

- Mark Whittle, CSES (lead author and evaluation)
- Shane Rimmer, CSES associate (implementation review)
- Stephan Kreutzer, CSES (implementation review and evaluation)
- Markus Petz, ACCON (case study data collection and analysis)
- Petrina Rowcroft, AECOM (cost-benefit assessment)

Quality review of specific aspects of the study has been undertaken at various stages of the assignment by Colin Grimwood (CJGEM) and Paul Shields (AECOM).

The following consultants have also made important contributions to the research:

- Colin Grimwood, CJG Environmental Management (EU-level research and analysis, workshop, lead country researcher for the UK)
- Abigail Bristow, AECOM associate consultant (QA and advisory work on the cost-benefit assessment)

The following consultants were involved as country researchers for the second implementation review.

- Mark Whittle, CSES, country researcher - France, Ireland, Latvia, Lithuania, Luxembourg, Netherlands and partly the UK.
- Stephan Kreutzer, CSES, country researcher - Denmark and Estonia.
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- Markus Petz and Madeleine Kaulisch, ACCON - Germany and Austria.
- Graham Parry, ACCON – workshop and support in editing / language country reports.

Acknowledgements

The team of authors would like to extend their thanks to all stakeholders that participated in the interview programme, online survey and in the validation workshop held on 23rd September 2015. We would also like to extend our thanks to Unit F3 of DG Environment and to the wider members of the Steering Group for their feedback and comments on written reports during the preparation of the second implementation review and evaluation.

A Brief Summary

This study presents the findings from the second implementation review and the evaluation of the Environmental Noise Directive ("END"), carried out under the EC's REFIT programme.

The study has drawn on desk research, an online survey, an interview programme with more than 100 stakeholders across all EU Member States and a workshop (September 2015) to validate the results.

The Directive's objectives were found to remain relevant to identified policy needs, and coherent with other EU and national legislation (although internal coherence within the legal text could be improved). Regarding effectiveness, it was found that progress has been made towards the two core objectives of the END (a "common approach" to noise management and informing EU noise-at-source legislation), but implementation has been delayed in many MS, especially regarding action planning. The research also identified evidence of a favourable cost-benefit ratio at measure level, implying that the Directive has been efficient, as well as strong European Added Value. Whilst the Directive demonstrates fitness for purpose overall, there are a number of ways in which its effectiveness and impacts might be improved in future.

EXECUTIVE SUMMARY

1. INTRODUCTION

This Executive Summary sets out the findings and conclusions from the second implementation review and evaluation of the Environmental Noise Directive (the "END"). The study was undertaken by the Centre for Strategy & Evaluation Services and ACCON, supported by AECOM.

1.1. Directive 2002/49/EC

Directive 2002/49/EC (the Environmental Noise Directive, "END") is the EU legislative instrument for the assessment and management of environmental noise[1]. The Directive was adopted on 25 June 2002, and came into force on 18 July 2002. The END has two objectives:

- Art. 1(1) - Achieve a **common European approach** to **avoid, prevent** or **reduce** the effects of exposure to environmental noise harmful for health, which includes annoyance; and
- Art. 1(2) – to provide a basis for developing **Community measures to reduce noise emitted by major sources**, in particular road and rail vehicles and infrastructure, aircraft, outdoor and industrial equipment and mobile machinery.

The END is being implemented over 5-yearly cycles (rounds). Round 1 took place from 2007-2012 and Round 2 is taking place between 2012-2017.

1.2. Objectives of the second implementation review

Under Article 11(1), a review of the Directive's implementation is required once every five years. A technical study[2] to inform the first implementation review of the END was undertaken in 2010 and the European Commission ("EC") published a Report outlining the findings from the first implementation review in 2011[3]. The second implementation review assessed progress over the most recent five-year implementation period, taking into account the evolution in implementation (and any changes in administrative approaches and in national transposition legislation) between R1 and R2. The objectives of the second implementation review of the END were to:

- Assess the legal and administrative implementation of the Directive and its key provisions across EU28 and by Member State ("MS"); and
- Identify difficulties experienced by competent authorities in implementing these provisions.

The extent to which challenges and outstanding issues identified in the first implementation review have remained or been addressed in R2 through remedial actions was examined. The research also assessed how far any new challenges or implementation issues have emerged during R2.

[1] Environmental noise is defined in the Directive as "unwanted or harmful outdoor sound created by human activities, including noise emitted by transport, road traffic, rail traffic, air traffic and from sites of industrial activity".

[2] Final Report on Task 1, Review of the Implementation of Directive 2002/49/EC on Environmental Noise, May 2010, Milieu

[3] COM (2011) 321 final of 1st June 2011, http://eur-lex.europa.eu/legal-content/EN/TXT/DOC/?uri=CELEX:52011DC0321&from=EN

1.3. Objectives and scope of the evaluation

The European Commission ("EC") announced in 2013 in its Communication on Regulatory Fitness and Performance (REFIT)[4] that an evaluation of the END would be undertaken, an evidence-based assessment as to whether EU actions are proportionate and delivering on defined policy objectives. The objective was to evaluate the Directive within the REFIT programme framework[5]. The evaluation was undertaken drawing on methodological guidance on evaluation[6] and a detailed set of evaluation questions were assessed, based on the criteria of *relevance, coherence, effectiveness, efficiency* and *European Added Value*. In a REFIT context, checking whether the END is 'fit for purpose' and provides a *"simple, clear, stable and predictable regulatory framework"* is an issue cutting across each of these evaluation criteria. The evaluation scope covered the period from the Directive's adoption in 2002 until late 2015.

1.4. Methodology

The study methodology was structured over three phases, an inception phase, a core data collection phase and an analysis and reporting phase. The research methods used to collect and analyse the data are summarised in the following table:

Table 1 Research methods for data collection – Second implementation review and evaluation of the END
Interview programme – interviews with 104 END stakeholders (e.g. competent authorities, EU industry associations, acoustics consultants, NGOs and community organisations).
Online survey - three online surveys were carried out between March-May 2015 with (i) public authorities (ii) NGOs/ community groups and (iii) acoustics consultancies.
Validation workshop – three working papers were presented and discussed at the workshop on (1) the second implementation review (2) the REFIT evaluation of the END and 3) on the proposed methodology for the cost-benefit assessment ("CBA"). Input was collected from stakeholders participating in and following the workshop.
Desk research – literature from the EU and national sources was examined such as the Directive's legal text, good practice guidance documents (e.g. on quiet areas, noise mapping) a review of a sample of Strategic Noise Maps ("SNMs") and Noise Action Plans ("NAPs") was undertaken, and an assessment of 'state of the art' methodologies to quantify the costs and benefits of environmental noise and their health effects.
Case studies – for the assessment of costs and benefits (which informed the CBA), 19 case studies examining noise reduction measures were undertaken for airports (5), major railways (2) and major roads (2). Less data was available for agglomerations (10). The purpose was to identify the costs/ benefits.

2. KEY FINDINGS - SECOND IMPLEMENTATION REVIEW

The main findings from the Second Implementation Review of the END are now summarised.

2.1 The overall approach to END implementation and legislative transposition

- Considerable differences between "MS" were identified in respect of END implementation approaches, such as more centralised and decentralised approaches. The administrative level at which implementation takes place (i.e. national, regional

[4] COM(2013)685 final

[5] http://ec.europa.eu/smart-regulation/refit/index_en.htm

[6] See http://ec.europa.eu/smart-regulation/evaluation/docs/20131111_guidelines_pc_part_i_ii_clean.pdf and *Evaluating EU Activities: A practical guide for Commission services (2004)*

and local) was found to vary between agglomerations, roads, railways and airports. This reflects the fact that the END is implemented under the subsidiarity principle.

- The transition to the definitive thresholds of the END between R1 and R2 has increased the scope of END coverage, with a significant increase in the volume of km's (major roads, major railways) and in the number of agglomerations and airports covered.
- There have continued to be considerable delays in END implementation in R2 in ensuring that all EU MS submit SNMs and NAPs by the dates stipulated in the Directive (c.f. Art. 7, Art. 8). However, similar difficulties were also encountered in R1.
- The END and its definitions have generally been correctly transposed into national legislation, either through the adoption of new implementing regulations or through adjustments to existing legislation.
- However, in some EU MS, there have been problems in ensuring that national legislation transposing the END correctly transposes all the definitions of key terms and that the terminology used is sufficiently close to the concepts described in the END (e.g. quiet areas in an agglomeration).

2.2 Designation and delimitation of agglomerations, major roads, major railways and airports

- No significant problems were identified in the designation of major roads, major railways, airports and agglomerations that fall within the scope of the END, since the definitions of thresholds were regarded as being clear.
- However, in some MS, there remain practical challenges within agglomerations, relating to the delimitation of administrative responsibilities between national bodies and local authorities for the purposes of producing SNMs. This is especially the case for major railways and major roads situated within agglomerations.

2.3 Noise limits and targets

- Although the END does not set any source-specific limit values ("LVs") at an EU level, establishing national LVs was viewed as being helpful by national Competent Authorities ("CAs") in many EU MS, since exceedance was often used as the basis for prioritising noise mitigation measures.
- Whilst mandatory noise LVs have been set in 21 EU MS, and non-binding targets in a further 4 EU MS[7], there was limited evidence of their effective enforcement either in R1 or R2. However, since national LVs are a MS responsibility, this is outside the END's scope.

2.4 Quiet areas

- Although many MS have made progress in developing definitions of quiet areas (in agglomerations and open country) and in defining selection criteria to designate quiet areas, less than half of all EU MS (13) have yet designated any quiet areas.
- Nevertheless, in those EU MS that have formally designated or identified quiet areas, their number has increased considerably between R1 and R2.
- There remains a perceived need among stakeholders for the EC to develop further practical guidance on quiet areas, regarding their initial designation, the types of measures that could be implemented to ensure their subsequent protection and how to preserve areas of 'relative quiet' within urban areas.
- A reluctance was identified in some MS to designate quiet areas due to uncertainty with regard to whether the process could be reversed in future and also whether a

[7] Denmark has both binding and indicative values in place, depending on noise source.

designated quiet area could be subject to legal challenges (e.g. by developers, local authorities etc.).

2.5 Strategic Noise Maps (SNMs)

- Across EU-28, good progress has been made in undertaking strategic noise mapping and in collecting data on population exposure to high levels of environmental noise, defined as L_{den}>55 dB(A) and L_{night} >50 dB(A).
- The L_{den} and L_{night} indicators are being used by CAs responsible for noise mapping across the EU and these indicators, sometimes complemented by additional national noise indicators.
- There have been significant delays in some EU MS in both R1 and R2 in the submission of SNMs to the EC (and also instances of non-submission). It is difficult to compare data completeness between rounds however, since this would be dependent on having comparable data with a similar cut-off date.
- Problems remain with regard to the late submission of SNMs in respect of aircraft noise within agglomerations (only 52% complete) and major railways and airports in general. Major delays in carrying out strategic noise mapping and in reporting SNMs to the EC were generally recognised as a problem by CAs in those MS concerned.
- Ongoing barriers to producing SNMs on a more timely basis identified are: a lack of human and financial resources within CAs in EU MS with a highly decentralised implementation structure, overly complex administrative arrangements leading to difficulties in ensuring effective coordination and a lack of political will at local level to allocate resources, especially where no central government funding was available.
- In both R1 and R2, most CAs outsourced noise mapping to acoustics consultants. Nevertheless, CAs gained experience in coordinating the production of SNMs in R1 and in better defining their procurement needs.
- In some EU MS, evidence was identified that there were cost reductions in R2 implementation as a result of the strengthening capacity to procure such services.
- Over half of MS attested to discernible improvements in R2 in the quality and availability of input data in R2 compared with R1. In other MS, difficulties remain in respect of the lack of input data in both rounds.
- Examples were identified of delays in the procurement of noise mapping services in R2 due to delays in the political approval of budgets for noise mapping due to the economic and financial crisis, and delays in the timely availability of input data (especially population census data).

Common assessment methods and data comparability

- Ensuring adequate continuity and consistency between rounds in input data collection was identified as being important to ensure comparability of output data during strategic noise mapping. Some stakeholders argued that input data needs to become more standardised to strengthen its comparability. However, other stakeholders questioned whether this was realistic, since the required data is context-specific.

- There was broad recognition that the development of common noise assessment methods through the development of the CNOSSOS-EU methodology between 2009 and 2015 was a major achievement. The replacement of Annex II of the Directive with Commission Directive (EU) 2015/996 should, over time, lead to more comparable data which is a pre-requisite in order to better inform the development / revision of source legislation by transport source.
- Ensuring data comparability between rounds for the same source and between EU MS will remain a challenge until Commission Directive (EU) 2015/996 has been implemented on a mandatory basis from R4 onwards. Currently, there are differences in the noise modelling software and computation methods used for mapping the same

source between rounds in some EU MS, such that consistent comparability cannot yet be ensured across EU-28.

2.6 Noise Action Plans and Public Consultations

The completeness of reporting data and information - NAPs

- There have been delays in the submission of R2 NAPs in several MS (for instance, in CZ, EL, ES, FR, LU, MT, PT and RO). The most recent reporting information on data completeness shows that more than 2 years after the formal reporting deadline for R2, NAP submission completeness is below 50% across all sources[8], with pronounced gaps for major railways and airports.
- However, it should be emphasised that the delays encountered in reporting to the EC are not unique to R2. Delays were also encountered in R1 NAP submissions in several MS (including several that have also experienced delays in R2).
- Delays in the finalisation of R2 SNMs in several MS have had a knock-on effect in terms of the timeframe for the drawing up and submission of NAPs to the EC.
- The timeframe of 12 months between the formal reporting deadline to the EC for the submission of SNMs and NAPs was viewed by the majority of stakeholders as being too short to allow sufficient time for NAP finalisation.
- Stakeholders pointed to the need to allow adequate time to organise public consultation processes, to review consultation submissions and to give adequate consideration to the integration of feedback into the finalisation of NAPs.
- A particular problem was identified in respect of the timeliness of the completion of NAPs in agglomerations. In MS that have adopted a decentralised approach to END implementation, it was found that when many different actors are involved, it can be difficult to coordinate the development and finalisation of NAPs in an efficient and timely manner.
- There are divergent approaches to action planning between MS due to the fact that the END is implemented under subsidiarity. This is reflected in the types of noise mitigation, abatement and reduction measures identified, the balance between expenditure/ non-expenditure measures[9] and the extent to which there is a strategic or operational focus.
- Although some R2 NAPs include cost-benefit information, others include no data at all, or only partial data, for instance, on the estimated costs but nothing on the anticipated benefits, required under the 'financial information' section in Annex V *(minimum requirements for NAPs)*.
- There was not found to be a major improvement in the quality of cost-benefit information and data between rounds. Stakeholders attributed this to the complexity of assessing costs and benefits at measure level.

Public Consultations of NAPs

- The quality of consultation responses to the publication of draft NAPs was found to vary. Whilst some CAs were satisfied with the quantity and quality of feedback received, others had received little input from relevant stakeholders, despite informing on the consultation in advance.
- NGOs that have participated in consultations stated that although NAPs often include a summary of the consultation responses, it is often unclear how these responses have been taken into account in NAP finalisation.

[8] However, this depends on what is meant by data completeness, since some competent authorities have understood that they should only formally submit a summary of the NAP, as opposed to the complete NAP.

[9] Soft measures that do not require expenditure, such as encouraging greater use of public transport and promoting walking and cycling are a feature of some NAPs.

- Examples of good practices in carrying out consultations were identified, such as ensuring that the draft version of the NAP is published at the outset of the consultation process (and/ or before it is launched), and running the consultation for a minimum period of 2 months to allow sufficient time for stakeholders to review the draft NAP and to develop a considered response. Proper assessment of responses lengthens the time for the preparation, development and finalisation of NAPs, which is not currently taken into account in EU reporting timelines.

The implementation of NAPs

- A difficulty in respect of measure implementation within agglomerations was that the CAs responsible for developing the NAP (often local authorities) do not have strategic or budgetary decision-making powers to determine whether measures included within NAPs are realistic, feasible and can be funded. This was less of a problem for other sources, such as major railways and major roads, where the responsible CA for action planning sometimes also has budgetary or decision-making powers.
- NAPs are meant to report on the previous 5 year period of implementation, but many NAPs do not report systematically on the achievements of the previous 5 year cycle in terms of which measures have gone ahead in full, partially or not at all.

Information accessibility of SNMs and NAPs

- Almost all EU MS have made SNMs available and accessible to the public online. Noise maps have been made available through different website information portals at national, city and municipal levels. From a citizen's perspective, it is important to have access to SNMs covering a given locality at a local level of governance.
- However, continued delays in the submission of reporting data and information for noise mapping and action planning in R2 mean that in some EU MS, SNMs and NAPs are still not being made accessible online until several years after they were meant to be completed and publicised.
- It would also be useful from the point of view of monitoring the overall implementation position at an EU level (and also for policy makers) to provide in addition access to SNMs and NAPs prepared at national level (e.g. especially for major railways and major roads) through a single information portal to avoid the over-fragmentation of information.

3. EVALUATION FRAMEWORK AND KEY FINDINGS

3.1. Key Evaluation Findings

The evaluation findings are now presented grouped under the key evaluation criteria.

3.1.1. Relevance

Art 1(1) of the END, of *"defining a common approach to **avoid, prevent** or **reduce** the effects of exposure to environmental noise harmful for health"*, remains highly relevant. Collecting comparable data/ information based on a common, EU-wide approach to assessing the extent of population exposure at specific dB(A) thresholds is a pre-requisite to achieving the END's second objective, informing the development of noise measures through EU source legislation. Stakeholders also recognised that the Directive's second objective remains highly relevant since EU policy makers responsible for the revision of existing environmental noise-at-source legislation are dependent on the availability of EU-wide, reliable population exposure data at receptor, for instance, to help set appropriate Limit Values in source legislation.

Whilst the Directive's two core objectives remain relevant, Art. 1(1) sets out an intermediate objective of defining a "common approach", but lacks a more strategic objective pertaining to what the Directive's implementation should ultimately lead to, such as setting a target for reducing environmental noise exposure in Europe by a particular percentage relating to the number of people exposed to high noise levels.

The ultimate goal, alleviating the adverse impacts on public health, is presently implicit in the recitals, rather than explicit in the objectives. This makes it difficult to directly attribute measure implementation and the resulting level of noise reduction to the END itself.

3.1.2. Coherence

In relation to '**internal coherence',** the Directive was found to be generally **consistent and coherent**. However, there remain minor inconsistences in the legal text. In addition, some of the definitions provided in Art. 3 *(e.g. agglomeration, quiet area in an agglomeration and quiet area in open country)* were regarded as being in need of revision or further clarification to strengthen the internal coherence of the text.

With regard to **'external coherence'**, the END was found to be strongly coherent with EU noise-at-source legislation. No major inconsistences or duplications were identified in the assessment of different legal texts. However, since the END was adopted 14 years ago, when the legal text is reviewed at some point in future and updated to ensure consistency with changes to primary legislation (e.g. the entry into force of the Lisbon Treaty in December 2009).

National noise control legislation has been transposed in a way that is coherent with the END, although in the early stages of the Directive's transposition, there were practical challenges in the 13 countries that already had such legislation in place prior to the Directive's adoption to update and ensure consistency with national legislation.

3.1.3. Effectiveness and Impacts

There has been **significant progress in defining a 'common approach'** (Art 1(1)). In particular, the development of common noise assessment methods through CNOSSOS-EU[10] and the replacement of Annex II of the END with Commission Directive (EU) 2015/996 is a major achievement and was acknowledged as such by END stakeholders. The study found evidence that **scientific and technical progress in noise measurement** had been taken into account in the phased development of CNOSSOS-EU (2009-2015). A long timeframe was required, reflecting its technical complexity and the need to allow sufficient time for MS to make the transition from the use of interim and national approaches to common assessment methods.

However, the full implementation of a common approach is dependent on the implementation of Commission Directive (EU) 2015/996 from R4, when SNMs will be produced on a common basis. Population exposure data was found to be not yet fully comparable across EU-28 between rounds. The data should become comparable in future however. In terms of progress towards a common approach in measuring the **harmful effects of noise**, the EC has commenced work to develop assessment methods on dose-response relationships for Annex III. However, finalising Annex III is dependent on the WHO finalising their own guidance on dose-response relationships, expected in 2017.

The late submission of **SNM and population exposure data and of the submission of action plans to the EC** through reporting processes in at least some EU MS in R1 and R2 has undermined the effectiveness of implementation. A lack of timely data and information completeness across EU-28 makes it more difficult to utilise MS submissions, for instance, for the EC, to report on the situation across the EU (Art. 11) and to inform source legislation (Art. 1(2)).

[10] https://ec.europa.eu/jrc/sites/default/files/cnossos-eu%2520jrc%2520reference%2520report_final_on%2520line%2520version_10%2520august%25202012.pdf

In relation to the **second objective,** the research identified evidence that the END has already played an important role in informing the development of source legislation. The END provides a strategic reference point, and has been referred to in the recitals of other EU noise-related legislation and in relevant impact assessments. Source legislation revised in the past three years has made explicit reference to linkages between source legislation and the END. However, exposure data collected through the END has not yet been directly used by EU source policy makers.

The research found that activities relating to the first objective of the END have had a number of **positive impacts**, such as promoting a more strategic approach to environmental noise management, mitigation and reduction through action planning, strengthening the visibility of environmental noise and the adverse health effects of high levels of noise (at receptor) for EU citizens, and increasing policy attention at MS level.

Awareness has been heightened among policy makers not specialising in environmental noise (e.g. transport planning, infrastructure development, urban development and planning) about the importance of building in environmental noise mitigation and abatement from the outset of the legislative development, policy-making and the programme design process, with evidence of more "joined-up" working between different stakeholder organisations that have different roles and responsibilities.

Enforcement was an aspect of END implementation where weaknesses were identified. Although the EC could potentially take action against EU MS for the late submission of legally-required reporting information and data to the EC through infringement procedures, according to MS CAs interviewed in 2015, the EC has not yet done so.

3.1.4. Efficiency

The **administrative costs** of implementing the END were found to have remained stable between rounds in absolute terms with at least €75.8m each spent by 23 EU MS who provided data. When extrapolated to EU28 aggregate level, the total costs would be €80.3m in R1 and €107.4m in R2. Given the increased volume of noise mapping and action planning requirements in R2, which has approximately doubled due to the transition to the definitive END thresholds, this points to a reduction in the costs of procuring external noise mapping services and the absence of one-off regulatory implementation costs (such as familiarisation with the legislative requirements and information obligations) in R2. The median costs per inhabitant (out of the **total population** of 11 EU MS who provided the necessary data) for noise mapping – circa €0.15 – and for action planning - €0.03 – were low. The estimated costs per **affected inhabitant** estimated by acoustics consultancies were €0.50 – €1.00 (noise mapping only) and €1.50 - €2.00 (noise mapping, action planning and the organisation of public consultations, but only in instances where external technical support was procured to assist competent authorities).

Given that END implementation costs are borne by public administration, and ultimately by the taxpayers in each country, it seems more appropriate to use the competent authority data of €0.15 and €0.03 figures as a benchmark for the administrative costs of END implementation, since this applies to the total population, not only the exposed population. However, even the estimate of €1.50-€2.00 per affected inhabitant shows that when looking at the affected population in isolation, the administrative costs were found to be proportionate relative to the benefits (for a quantitative assessment of benefits, see CBA below, for a qualitative assessment, see effectiveness section in main report).

A **cost-benefit analysis (CBA)** was conducted to quantify (in monetary terms) the cost-effectiveness of the END. The benefits are mainly gained by the population affected by excessive noise. It was not possible to quantify some of the strategic benefits of the END, such as its role in stimulating awareness of noise as an issue, facilitating the generation of large and consistent spatial datasets on noise exposure and supporting

actions in other areas (e.g. development of technical standards). The CBA is therefore based primarily on an assessment of the contribution made by measures identified in R1 NAPs to reducing exposure to harmful levels of noise.

The analysis revealed that the END has made a positive contribution to reducing population exposure to high levels of environmental noise. Whilst the **magnitude of costs and benefits** of noise mitigation measures was found to vary between countries and sources, a positive cost-benefit relationship was identified under a range of scenarios, where the scenarios reflect both differences in the underlying assumptions regarding the extent to which costs and benefits can be attributed to the END and the range of uncertainty in relation to the value of impacts on human health. The base case scenario results in a favourable cost-benefit ratio (of 1:29) overall, although the ratios vary substantially between measures. The benefits are likely to be understated, since the analysis only considered the effects of noise reduction on the 'highly annoyed' and 'highly sleep disturbed' populations. It should be noted that whilst the CBA is an important element of assessing efficiency, measure-level data only provides a proxy, since NAP measure implementation is not compulsory and does not take into account the strategic, qualitative benefits of the END (see impacts under "effectiveness").

The END has already made a **positive contribution to reducing noise through the implementation of (voluntary) measures in NAPs** that have either been fully or partially implemented. These estimates suggest that the benefits from efforts to reduce noise from all sources across the EU-28 are substantial, even if only a proportion of the total benefits can be attributed to the END (since other policy drivers can explain why some measures not directly targeting noise reduction go ahead e.g. air quality, planned transport infrastructure development). Less positively, fewer R1 measures went ahead than expected due to the global economic and financial crisis, which affected the budget available for noise mitigation in many EU MS.

The END Reporting Mechanism ("ENDRM") was found to be **generally efficient in collecting SNMs (and population exposure data) and NAPs from EU MS** since competent authorities that are members of EIONET can already access Reportnet for broader environmental reporting purposes. However, there is scope to simplify reporting processes and to make Reportnet more user-friendly for national competent authorities and the ease of data extraction at EU level could be improved. Further clarification is also needed as to which types of data within, and outside agglomerations should be submitted under each source, since presently, there are some areas where the lack of clarity as to what information is meant to be reported could lead to inconsistencies in data comparability.

3.1.5. European Added Value ("EAV")

Overall, the END demonstrates strong EAV, by providing an **EU-wide regulatory framework to collect noise mapping data on population exposure on environmental noise at receptor on a common basis**. There was found to be a clear EAV for EU policy makers responsible for source legislation since they need complete and comparable population exposure data at EU level to inform the development of source legislation. The END has also added value through the collection of population exposure data across EU-28 so as to better monitor and assess the impact of environmental noise at receptor on health (previously, at national level, population exposure data was not generally available to the public).

The research identified differences among END stakeholders in perceptions of EAV between EU MS where national legislation on noise was already in place prior to the END (13), and MS where there was previously no legislative framework (15). In MS without any prior environmental noise legislation, the END has helped to enhance the visibility of environmental noise domestically and has made environmental noise issues more prominent in national policy-making and made noise mitigation more visible in national and regional public expenditure programmes (e.g. road building and transport

infrastructure development, urban planning and land use). Where national legislation on noise was already in place prior to the END, there was still perceived to be strong added value, since it was recognised that a European approach had facilitated data collection across the EU and promoted the exchange of experiences and benchmarking.

Putting in place a five-yearly noise action planning process through the END has added value by **promoting a more strategic approach to environmental noise management and mitigation** across the EU than existed previously in most countries, including those that already had a national regulatory framework. MS were positive about the usefulness of action planning and appreciated the considerable flexibility in national implementation approaches that the END allows, reflecting subsidiarity. Even though END stakeholders recognised that there are still various ways in which the END might be improved in future, they were strongly against the "counterfactual scenario" of the Directive's possible repeal, examined in the context of the Fitness Check.

3.1.6. Overall conclusions

The evaluation has involved a detailed assessment of key evaluation issues relating to the END's implementation to date. The conclusions are that:

- The END is fit for purpose overall, although there are a number of ways in which its effectiveness and impacts might be improved in future, as detailed in the "future perspectives" section of the final report.
- The longer-term objective as to what the END is ultimately trying to achieve (reducing the incidence of high levels of environmental noise) across different transport sources needs to be made more explicit.
- The Directive overall and the specific requirements relating to the achievement of the first objective of the END (noise mapping and action planning under Article 1(1)), are widely accepted by stakeholders.
- Whilst significant progress has been made towards the first objective of the END of a "common approach" (under Article 1(1)), especially in respect of the use of common assessment methods, the lack of time availability of a complete reporting information dataset on SNMs and NAPs in both R1 and R2 continues to undermine the END's full and effective implementation.
- Although the use of public consultation is effective in some countries, the role of public consultation could be strengthened in others.
- The lack of EU-level enforcement actions to date to ensure the timely delivery of reporting information in respect of SNMs and NAPs has arguably hindered achieving the END's full impact. However, in the view of the evaluators, launching infringement proceedings may not always be an appropriate mechanism when delays occur, given that national CAs in some EU MS face resource constraints to implement the END, and some stakeholders pointed to cumbersome data entry reporting procedures for submission to the EC.
- Without the existence of the END, there would be less attention to tackling the problem of high levels of environmental noise across EU-28 as a whole, some EU MS would not have introduced any legislation and only minimum numbers of noise maps and population exposure data would have been made publicly available.
- The measure-level assessment has identified positive cost-benefit relationships for investing in noise mitigation, abatement and reduction measures across all transport sources – major railways, major roads and airports.
- Overall, the END was found to be cost-effective, although its full potential has not yet been reached, but this will be strengthened once the data is fully comparable, and is being actively used by EU policy makers responsible for source legislation.

1. INTRODUCTION AND BACKGROUND

This introductory section sets out the study objectives and scope of the second implementation review and evaluation of the Environmental Noise Directive (the "END"). It summarises the baseline situation in respect of the problem of high levels of environmental noise in the EU, and considers the scale of the problem by transport source.

The competences of the Member States ("MS") and the EU in END implementation are then considered. The Directive's objectives and the implementation context are then summarised. It should be noted that the methodology adopted is described in Section 2.2 (second implementation review) and Section 3.1.3 (evaluation).

1.1 Study objectives

The study objectives are, in summary, to:

- Carry out the second implementation review of Directive 2002/49/EC relating to the assessment and management of environmental noise ("the END"); and
- Undertake an evaluation of the Directive within the framework of the European Commission's Regulatory Fitness and Performance programme (REFIT)[11].

Section 2 of this report provides an assessment of the findings from the second implementation review. Section 3 sets out the evaluation findings grouped around the five key evaluation issues that are central in all REFIT evaluation studies, namely the *relevance, effectiveness, efficiency, coherence* and *EU added value* of the END. In accordance with a REFIT evaluation carried out in the context of the wider Better Regulation agenda, *fitness for purpose* was an important issue considered across all the evaluation issues.

Given the complex and technical nature of the END and its implementation, the evaluation has characteristics of an interim evaluation. For instance, progress towards a "common approach" to noise measurement through the development of common noise assessment methods (Annex II) and progress towards the development of common EU level dose-response relationships, which is transport source-specific, requires considerable technical work, with a need to take into account scientific progress and technical 'state of the art'. Further details of the progress made to date and the long-term nature of the achievement of a common approach is set out in Section 3.2.3 under the effectiveness criterion.

1.2 Study scope and Steering

Since an implementation report is required once every five years under Art. 11 of the Directive, the time scope of the **second implementation review** of the END focuses on the second round of noise mapping and action planning (2012-2017). However, in order to assess differences between Rounds 1 and 2, the implementation review also provides an overall assessment of administrative and legal implementation to date.

The purpose is to identify the extent to which implementation challenges and problems identified in R1 have been addressed, or remain in R2. The **evaluation scope** covers the period since the Directive's adoption until November 2015. In terms of the time cut-off for different aspects of the data analysis:

- Data completeness in respect of action plans – November 2015

[11] http://ec.europa.eu/smart-regulation/refit/index_en.htm

- Data completeness in respect of noise maps – 30 June 2015, the cut-off date the EEA used for their latest update.
- Administrative cost data – received from EU MS up to November 2015.
- Written contributions to the working papers prepared for the validation workshop were also received into November 2015.

A Steering Group ("SG") was established by the European Commission ("EC") so as to guide the evaluation process and provide expert technical feedback on key deliverables. This was comprised of representatives from a number of Directorate Generals, namely ENV (F1 and F3), GROW, RTD and MOVE. The Secretariat General also participated, reflecting its central role in promoting Better Regulation through the REFIT programme. The EC's Joint Research Centre (JRC), which played an important technical role in the END's development (although it now only has an observer role), was also represented.

1.3 The problem of environmental noise in Europe

1.3.1 Overview and current situation

High levels of environmental noise (defined as noise levels above 55dB L_{den} and 50dB L_{night}), are a significant environmental health problem across the EU. The EEA's 2014 **Noise in Europe Report**[12] notes that a majority of Europeans living in major urban areas are exposed to high levels of noise, particularly traffic noise, and that adverse health effects frequently occur, particularly due to noise at night. The report states that population exposure due to environmental noise is a major health problem in Europe which "causes at least 10000 cases of premature death in Europe each year, with almost 20 million adults annoyed and a further 8 million suffering from sleep disturbance due to environmental noise". It also notes that noise pollution causes 43000 hospital admissions in Europe per year.

The **7th Environment Action Programme (7th EAP)**[13] provides an overarching policy framework for European environment policy until 2020 and sets out a long-term vision for 2050. Priority Objective 3 addresses challenges to 'human health and wellbeing', such as air and water pollution and **excessive noise.** Priority Objective 8 – 'Sustainable Cities' notes that "Europe is densely populated and 80 % of its citizens are likely to live in or near a city by 2020. Cities often share a common set of problems such as [*inter alia]* poor air quality and **high levels of noise".**

In order to safeguard the Union's citizens from environment-related pressures and risks to health and well-being, the 7th EAP aims to ensure that by 2020 noise pollution in the Union has significantly decreased, moving closer to the WHO recommended levels. It notes that this implies "implementing an updated Union noise policy aligned with the latest scientific knowledge, and measures to reduce noise at source, including improvements in city design".

The 7th EAP notes the important role of complementary EU legislation and policy initiatives in helping to reduce noise emissions, namely the Industrial Emissions Directive (IED) and the Roadmap to a Single European Transport Area. The earlier 6th EAP is also worth mentioning, since it specifically emphasised the concept of a knowledge-based approach to policy-making through the adoption of the END to strengthen understanding of the significant impacts on, and the risks to human health of environmental noise.

[12] Noise in Europe 2014 Report, EEA, 2014
[13] http://ec.europa.eu/environment/action-programme/

1.3.2 The adverse health effects of environmental noise

The three adverse effects of environmental noise within the scope of this study in terms of health end-points are: (1) Sleep disturbance (2) Annoyance and (3) Cardiovascular disease. The cost-benefit assessment ("CBA") set out in Section 3.2.5 of this report (by January 15th) considers these three health data end-points, where there is information available in the existing WHO guidelines[14] on dose-response relationships. The WHO guidelines are currently under revision and are expected to be issued in late 2016. Whilst other potential effects of environmental noise have been identified, such as tinnitus and cognitive impairment, the evidence supporting their inclusion is not yet robust enough (at least for tinnitus). The report therefore only considers the health endpoints as identified by the WHO.

The WHO's current 2009 guidelines[15] on night noise in Europe examine the negative effects on human health and well-being. The guidelines provide estimates of the adverse health effects of exposure to night-time noise, examine dose–effect relations and present interim guideline values for exposure. In 2011, the WHO also estimated the health effects of high levels of noise in Europe[16]. According to the WHO, a Disability-Adjusted Life Years (DALY) represents one lost year of "healthy" life. "The sum of these DALYs across the population, or the burden of disease, can be thought of as a measurement of the gap between current health status and an ideal health situation where the entire population lives to an advanced age, free of disease and disability"[17].

Using conservative assumptions, the guidelines estimated that the number of DALYs lost from environmental noise are 61,000 years for ischaemic heart disease, 45,000 years for cognitive impairment of children, 903,000 years for sleep disturbance, 22,000 years for tinnitus and 654,000 years for annoyance in EU MS. These results indicate that at least one million healthy life years are lost every year from traffic-related noise in Western Europe alone. Sleep disturbance and annoyance, mostly related to road traffic noise, are among the main burdens of environmental noise.

1.4 The objectives of Directive 2002/49/EC and implementing actions

The END was adopted on 25 June 2002 and came into force on 18 July 2002. It is the legislative tool for the assessment and management of environmental noise[18] at receptor. The END has two objectives, namely:

- Art. 1(1) - Achieve a **common European approach** to **avoid, prevent or reduce** the effects of exposure to environmental noise harmful for health, which includes annoyance; and
- Art. 1(2) – to provide a basis for developing **Community measures to reduce noise emitted by major sources,** in particular road and rail vehicles and infrastructure, aircraft, outdoor and industrial equipment and mobile machinery.

[14] http://www.euro.who.int/en/health-topics/environment-and-health/noise

[15] Night noise guidelines for Europe, WHO European Centre for Environment and Health, 2009 - http://www.euro.who.int/__data/assets/pdf_file/0017/43316/E92845.pdf

[16] The burden of disease from environmental noise through the quantification of healthy life years lost in Europe, WHO, 2011 - http://www.euro.who.int/__data/assets/pdf_file/0008/136466/e94888.pdf

[17] http://www.who.int/healthinfo/global_burden_disease/metrics_daly/en/

[18] In the END, environmental noise is defined as being unwanted or harmful outdoor sound created by human activities, including noise emitted by means of transport, road traffic, rail traffic, air traffic and from sites of industrial activity.

The first objective of the END is being implemented through a five yearly cycle which consists of three main actions (as described in Art. 1(1) a-c):

- **Action A - the development of Strategic Noise Maps (SNMs)** for all major roads, major railways, airports, and agglomerations of >100,000 inhabitants. Within agglomerations, roads, railways, airports and industrial installations are mapped. These provide five-yearly updates on the extent of population exposure by 5dB threshold;
- **Action B – information accessibility.** Ensuring that information on environmental noise and its effects is made available to the public; and
- **Action C – the preparation of Noise Action Plans (NAPs)** for noise management for all major roads, major railways and airports, as well as agglomerations.

For both mapping and action planning, according to the timetable outlined below, reporting in respect of the 2nd round should theoretically have been completed by now (although action plan and measure implementation should continue until the new Round 3). MS have recently (summer 2015) reported lists of entities for which they will need to do mapping and action planning in Round 3. The implementation of measures in action plans is halfway through the second round.

A summary is provided in the table on the following page as to the timing of R1 and R2 implementation (hereafter Round is abbreviated to "R" e.g. R1 and R2 etc.). In addition, the planned future timings of R3 and R4 are indicated.

Table 1.1 Summary of the timing of END implementation

Round and timing of 5 year cycle	Timing of submission of Strategic Noise Maps	Timing of submission of Noise Action Plans	Notes
Round 1 2007-2012	30 June 2007	18 July 2008	Delays encountered in some MS in submission of SNMs and NAPs
Round 2 2012 - 2017	30 June 2012	18 July 2013	Delays encountered in some MS in the submission of SNMs and NAPs.
Round 3 – 2017-2022	30 June 2017	18 July 2018	Use of CNOSSOS-EU methodology for noise mapping voluntary
Round 4 2022 - 2027	30 June 2022	18 July 2023	Use of CNOSSOS-EU methodology for noise mapping mandatory

It should be noted that in addition to these deadlines or data collection cut-off points, the EEA updates the Noise Viewer at regular intervals – the latest updates were made on the 28th of August 2013 (summarised in the EEA Report "Noise in Europe 2014"), 10th June 2014, and 30th June 2015. Those data have informed this study

1.5 The competences of the Member States and the EU in END implementation

1.5.1 The competences of the Member States

The END is implemented under the subsidiarity principle since the EU MS have competence for the management of environmental noise at receptor. This reflects the fact that taking action to mitigate environmental noise is an issue best tackled at local level. Recital 7 of the END points out that *"the Treaty objectives of achieving a* **high level of protection of the environment and health** *will be better reached by complementing the action of Member States by a Community action to achieve a common understanding of the noise problem.*

Data about environmental noise levels should therefore be collected, collated or reported in accordance with comparable criteria. This implies the use of harmonised indicators and evaluation methods, as well as criteria for the alignment of noise-mapping. Such criteria and methods can best be established by the Community".

Strategic noise mapping has initially been carried out on the basis of the national and interim methods (as set out in Annex II of the END), but in future will be based on common assessment methods developed at EU level through the CNOSSOS-EU process, and set out in Commission Directive (EU) 2015/996. Detailed noise mapping activities and noise action planning are carried out at MS level. Although there is no mandatory requirement to implement measures, Noise Action Plans (NAPs) should identify appropriate noise abatement, mitigation and reduction measures.

The preparation of NAPs (and their implementation) is also under the responsibility of Competent Authorities ("CAs") at national, regional and local levels. Under Art. 4 (Implementation and responsibilities), MS are required to designate at appropriate levels the CAs and bodies that are responsible for implementing the END, including the authorities responsible for: (a) making and, where relevant, approving Strategic Noise Maps ("SNMs") and NAPs for agglomerations, major roads, major railways and major airports; and (b) collecting noise maps and action plans.

1.5.2 The role of the European Commission in END implementation

The EC plays an important role in supporting END implementation, both in respect of the achievement of the first and second objectives of the END. In summary, its role can be summarised as follows:

- **Coordination –** the EU plays an overall coordination role in the Directive's implementation over a five year cycle;
- **Monitoring and reporting**
  - Reporting data and information has to be submitted by the Member States to the EC in respect of SNMs on population exposure by round and also summaries of NAPs.
  - The EEA then makes population exposure data available via the Noise Viewer and reports back to the EC on the extent to which SNMs comply with the END's requirements[19].
  - The EC has a number of monitoring and reporting responsibilities relating to the END, specifically through Art. 11 - Review and reporting. The EC is supported in carrying out these tasks by the EEA.
    - Art. 11(1) the EC has to submit a report on the Directive's

[19] http://noise.eionet.europa.eu/viewer.html

implementation every five years.

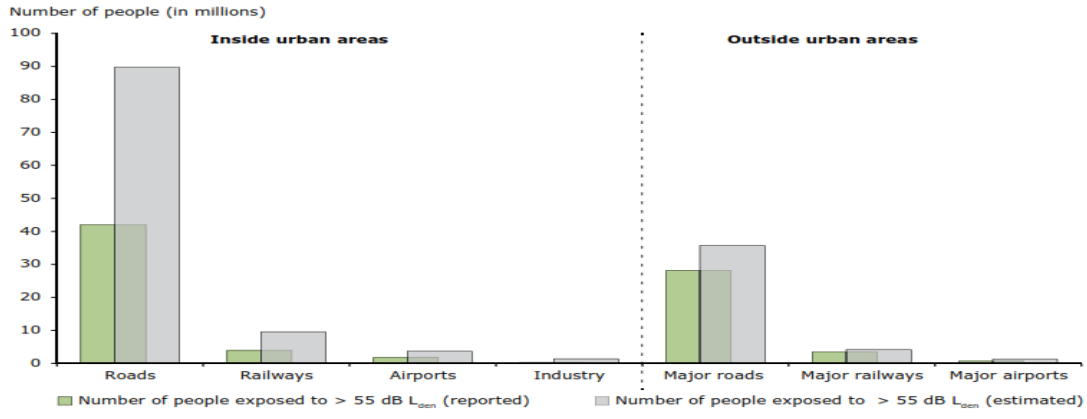
- Art 11(3) - an EU level report has to be produced to include a review of the acoustic environment quality in the EU based on the data referred to in Art. 10. This shall take account of scientific and technical progress and any other relevant information.

- **Informing the development of EU noise at source legislation**[20] – under Art. 1(2), the EEA supports the EC in collecting EU-wide data on population exposure data at receptor. This in turn supports EU decision makers by providing a more informed basis on which to review existing, and develop new source legislation.
- **The development of common noise assessment methods**, with support from the JRC, over a 10 year period in the form of a new assessment methodology relating to the revisions to Annex II of the END. The EC proposed a new draft Annex II, which was adopted by MS through Comitology and led to the adoption of a new Directive in 2015[21] to replace Annex II. The process was supported by technical working groups comprised of MS representatives.
- **The development of a common approach to Noise Assessment Methods for Harmful Effects (Annex III)** so as to be able to better measure the health effects of high levels of noise.

1.6 Noise at receptor by transport source

In order to assess progress to date in the Directive's implementation and its achievements against objectives, it is important to provide an overview of the current situation in respect of levels of population exposure to environmental noise and the extent to which different transport modes contribute to the problem, since this varies considerably between sources. It should be noted that different sources of transport noise at receptor have differing exposure-response relationships. Such contextual information is useful when assessing how the END has contributed to addressing the problem of high levels of noise across different sources, and also the most appropriate combination of measures to tackle noise at receptor and at source. Before addressing each of the transport sources addressed through the END separately, the Figure on the following page taken from the EEA Noise in Europe Report 2014 illustrates the different level of noise exposure by noise source

Figure 1.1 Number of people exposed to noise in Europe > 55 dB L_{den} in EEA member countries (2012): reported and estimated data



Source: EEA Noise in Europe Report 2014.

[20] http://ec.europa.eu/environment/noise/sources_en.htm

[21] DIRECTIVE (EU) 2015/996 of 19 May 2015 establishing common noise assessment methods according to Directive 2002/49/EC

The data shows that road traffic noise is the most significant problem in terms of the number of people exposed, followed by noise from railways. Noise from airports and industry affects less people overall, but for some health end-points, the level of annoyance may on average be higher. For instance, the WHO report referred to above states that "at the same average noise level, aircraft noise tends to be more annoying and conventional railway noise less annoying than road traffic noise". This raises the issue of differences between sources of perceptions of noise rather than the number of people exposed measured through noise mapping. Different studies have also identified differences between sources in respect of other health end-points.

For instance, in the recently published NORAH study[22] in the Rhine-Main Region, it has been observed that railway noise may be especially problematic for cardiovascular diseases. Each of the main transport sources addressed through the END are now examined.

1.6.1 Noise from major roads

The END applies to **major roads.** The main sources of traffic noise are noise from noisy road surfaces, tyre rolling noise and aerodynamic noise from vehicles.

The EEA's 2014 Noise in Europe Report notes that road traffic noise is the most significant source of transport noise "with an estimated 125 million people affected by noise levels greater than 55 decibels (dB) L_{den} (day-evening-night level)" across the 33 EEA member countries (which includes all 28 EU Member States. WHO guidance[23] confirms that road traffic noise is the principal source of environmental noise.

According to the WHO[24], "results from epidemiological studies performed in past few years consistently indicate significant increases in the risk of myocardial infarction and elevated blood pressures among the population exposed to road or aircraft traffic noise". The WHO also notes in the same study that "one in three individuals is annoyed during the daytime and one in five has disturbed sleep at night because of traffic noise".

A report[25] by CE Delft in the Netherlands has sought to assess the health effects and social costs of environmental noise. Among the findings were that traffic noise is especially harmful to vulnerable groups, such as children, the elderly and the poor, who are disproportionately affected, being more likely than average to live in close proximity to major roads. The study also found that in the 22 countries covered by the research, the social costs of traffic noise were estimated at over EUR 40 billion a year. The study estimated that "road and rail traffic noise are responsible for around 50,000 premature deaths per year in Europe".

Among the most common measures identified to reduce, abate and mitigate road traffic noise at receptor are: traffic calming measures, speed reductions and the installation of noise barriers. However, literature on the potential impact of different measures suggests that technical measures to reduce noise emissions at source from vehicles and tyres and laying quiet road surfaces have the potential to bring about the greatest reduction in noise.

[22] http://www.laermstudie.de/fileadmin/files/Laermstudie/NORAH_Knowledge-14.pdf, pg. 8

[23] Burden of disease from environmental noise (quantification of healthy life years lost in Europe), WHO/JRC, 2011

[24] Burden of disease from environmental noise: Report on WG meeting, 14–15 October 2010

[25] Traffic noise reduction in Europe - Health effects, social costs and technical and policy options to reduce road and rail traffic noise, CE Delft, the Netherlands, 2007, Eelco den Boer, Arno Schroten.

1.6.2 Noise from major railways

The END also applies to **major railways.** The dominant source of railway noise is rolling noise from rail freight wagons. In addition, other types of noise include power equipment noise and aerodynamic noise. Data on population exposure collected through the END indicates that railways are the second greatest source of noise at receptor. This is confirmed in wider literature. For instance, according to a 2012 study for the EP[26], 12 million EU inhabitants are affected by railway noise during the day and 9 million during the night.

The situation varies significantly across different EU countries, since in some countries, there is a growing trend towards building residential housing ever closer to railways, due to lack of affordable housing and population growth. The study for the EP on railway noise found that the problem of railway noise is geographically "concentrated in central Europe, where the majority of the affected citizens live and the volume of rail freight transport is highest (primarily Germany, Italy and Switzerland, but traffic density is high also in Poland, Austria, the Netherlands and France, and noise mapping indicates that significant population is affected in Belgium and Luxembourg)".

In contrast with other sources addressed through the END, it can be noted that measures to tackle railway noise through abatement strategies often focus on tackling noise at source rather than at receptor since these are acknowledged as being most effective in tackling the core problem of rolling noise from trains and rolling stock.

Among the most common measures to tackle railway noise at source are the replacement of cast iron by composite brake blocks on rail freight cars to reduce rolling railway noise. The development of "European Railway Technical Specifications for Interoperability (TSIs)" which is formally part of an ongoing process of standardisation across Europe's railways, is equally concerned with noise reduction and mitigation. The main focus of mitigation measures has been on reducing noise levels for existing rolling stock[27], recently extended to include new rolling stock.

There has been tangible progress in reducing noise at source in the railways sector. For instance, according to the study carried out for the EP mentioned above, *"Rolling stock introduced from the year 2000 is about 10 dB(A) less noisy then rolling stock from the 1960s and 1970s".* However, the problem of population exposure at receptor remains significant, given the issue mentioned above of increased numbers of residential housing being built in close proximity to railways.

1.6.3 Noise from airports

Airports with more than 50,000 aircraft movements per annum fall within the scope of the END. **Aircraft noise** arises in close proximity to airports (i.e. take-off and landing) and along flight corridors within a certain radius of an airport when aircraft fly at lower altitude. Whilst airport noise is a significant problem for citizens living in residential areas either in proximity to major airports, or directly under the flight path, data shows that the number of persons exposed is comparatively fewer than for either roads or railways.

In assessing the impact of the END on airport noise, it is important to take into account the fact that there is broader relevant EU and national legislation to manage aircraft noise and noise at airports. At EU level, Directive 2002/30 concerning noise-related operating restrictions at EU airports was introduced, implementing the International

[26] Reducing Railway Noise Pollution, Policy Dept. B: Structural and Cohesion Policies - transport and tourism, Study for the European Parliament, 2012

[27] The new European Railway Technical Specification for Interoperability (TSI) for Noise (TSI Noise), document No. 2011/229/EU (published on April, 4th 2011) defines maximum noise levels for rolling stock [TSI Noise 2011].

Civil Aviation Organization's (ICAO) global agreement to ban older and noisier aircraft and the ICAO "Balanced Approach".

Regulation (EU) No 598/2014[28] replaced the 2002 Directive and reaffirms the principles of the ICAO 'Balanced Approach', which consist of four pillars: (1) reduction of noise at source, (2) land-use planning limiting population encroachment in the vicinity of airports, (3) operational improvements and (4) operating restrictions. The ICAO guidance stresses that (4) should be not as a first resort but after consideration of the three first options.

In addition, community engagement is a horizontal aspect that supports the implementation of the Balanced Approach. Noise at source standards for aircraft are also set by the ICAO and are implemented through EU source legislation, which is complementary to the END.

According to aviation industry sources, approximately a 50% reduction in aircraft noise at source has been achieved in the past 10 years and a 75% reduction compared with the first generation of jet aircraft[29] (equivalent to a 6dB reduction), reflecting investment by manufacturers in R&D to reduce aircraft noise at source through a combination of improvements in aircraft design (e.g. advanced aerodynamics, lighter aircraft etc.) and engine design (e.g. next generation engines). This development has been supported by the increasingly stringent standards for noise at source set by the International Civil Aviation Organization (ICAO), the United Nations' intergovernmental body on aviation, which date back to the 1970s.

In 2013, the ICAO introduced the fourth new noise certification standard in its history, Chapter 14. This set a requirement that new aircraft types should be least seven dB quieter than those built to the previous Chapter 4 standard. The purpose of aircraft noise standards is to ensure that the best noise technology continues to be used on future aircraft types. ICAO estimates that between 1998 and 2004, the number of people exposed to aircraft noise around the world was reduced by 35%[30].Procedural operating efficiencies have also been introduced, such as Continuous Descent Approaches and Continuous Climb Operations, which reduce noise by flying aircraft higher, routing aircraft differently within the airspace and/or optimising the use of engine thrust).

However, the problem of aviation noise close to major airports and under flight paths remains significant, since there has been considerable growth in the number of aircraft movements over the past two decades in many EU countries. In assessing the role of the END at national level, it should be recalled that in many Western EU countries, there are long-established noise regulations to address the problem of aircraft noise to protect residents living in close proximity to airports. In some countries, airports have committed significant expenditure in implementing noise insulation programmes for residents living close to airports. The impact of legislation other than the END in influencing changes in population exposure is taken into account in the cost-benefit assessment (see Section 3.2.3).

1.6.4 Noise within agglomerations

A number of different transport modes (i.e. major rail and major roads, air traffic), as well as industrial noise, are included within the scope of an **agglomeration** under the END.

[28] Regulation (EU) No 598/2014 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Union airports within a Balanced Approach.

[29] http://aviationbenefits.org/environmental-efficiency/noise/

[30] http://www.icao.int/environmental-protection/pages/noise.aspx

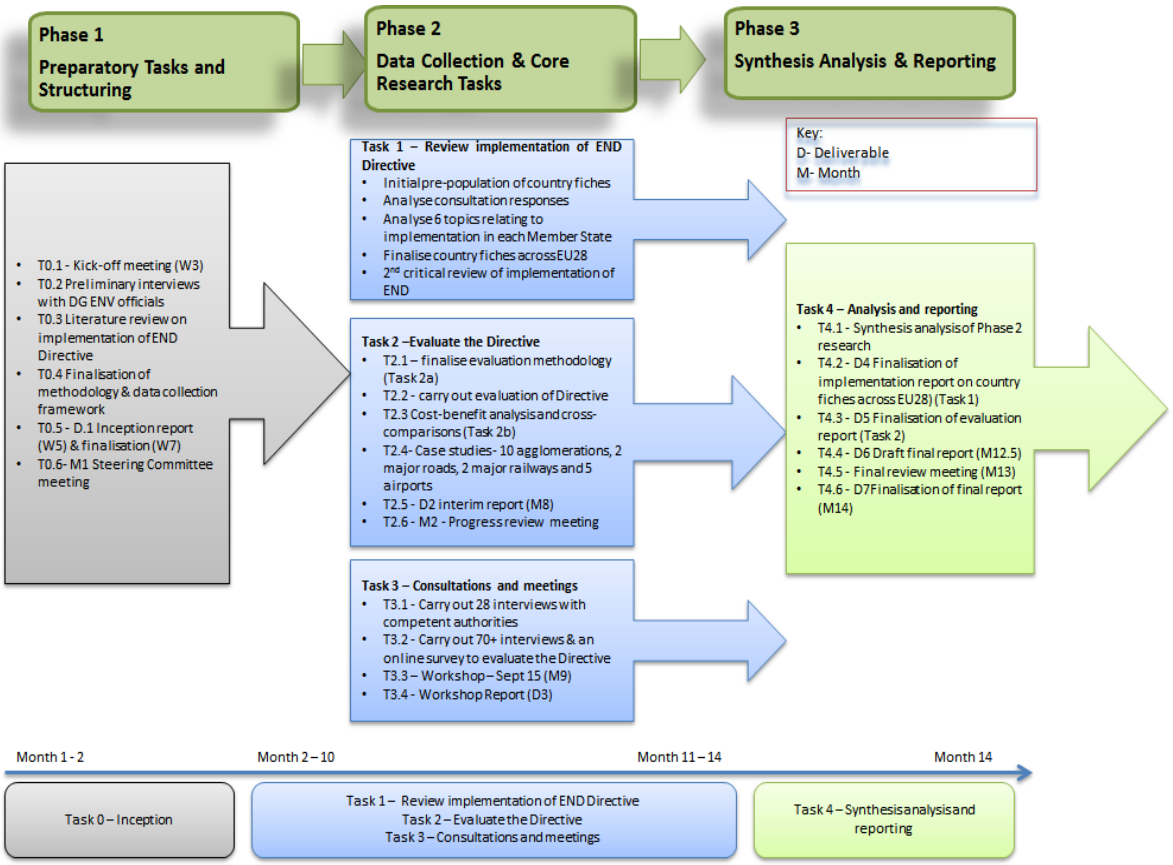
Whereas in R1, a transitional threshold applied to noise mapping and action planning in urban areas with > 250,000 population, in R2 (and also in future rounds), the definitive threshold of >100,000 inhabitants has been applied.

Since agglomerations address a number of different sources of noise, there are a wide variety of different types of measures designed to tackle environmental noise relating to roads, railways and airports. Since people in urban areas are exposed to noise from a number of different sources, the **cumulative effects of noise across different transport issues** are an important issue.

1.7 Overview of methodology

An overview of the methodology adopted to carry out this assignment is now provided. The methodological approach that was adopted is summarised in the following figure:

Figure 1.2 - Work plan overview



The assignment was carried out in three phases:

- **Phase 1 - Structuring phase**. The methodological approach was finalised, the data collection and analytical framework and research tools were prepared (e.g. interview checklists and online survey-based questionnaires);
- **Phase 2 - Core data collection phase.** This consisted of field research and the holding of a validation workshop on September 23rd 2015; and
- **Phase 3 – Analysis and final reporting.** An EU-wide synthesis analysis was carried out of the primary and secondary data collected through the study.

A number of different research methods have been used in order to collect primary and secondary data, as outlined in the following table:

Table 1.2 Research methods for data collection for the second implementation review and the REFIT Evaluation

Data type	Research method & detail
Primary	**Interview programme** with 106 END stakeholders designed to be geographically balanced and to include a representative sample of relevant stakeholders (e.g. CAs, other bodies at national, regional and local level involved in END implementation such as providing input data, NGOs and community organisations and EU industry associations). The interview feedback has been utilised to inform both the implementation review and evaluation. The interviews were facilitated using an interview guide, tailored to the different categories of stakeholders.
Primary	**Online survey -** three online surveys were carried out between March-May 2015 with (i) public authorities (ii) NGOs/ community groups and (iii) consultancies involved in the development of SNM and/ or providing technical assistance to assist in action plan development.
Primary	**Validation workshop** – a workshop was held on September 23rd 2015 to provide feedback on the preliminary evaluation findings. This was attended by 53 END stakeholders (a combination of CAs, industry associations, consultancies, NGOs etc.) and 70 people in total (including representatives from the EC and the contractor). Three working papers (WPs) were distributed in advance and presented at the workshop, namely : • WP1 - the second implementation review of the END. • WP2 – the evaluation of the END. • WP3 - the quantitative case study work and proposed methodological approach to cost-benefit assessment (CBA). Following the workshop, the working papers were published online[31] and non-participants had the opportunity to make comments in writing (20 responses were received from a combination of participants and wider organisations.
Secondary	**Desk research** – a wide range of documentation has been examined at EU and national levels for both the implementation review and evaluation (see Appendix B - bibliography). For the evaluation part, a review of 'state of the art' methodologies in relation to monetising the costs and benefits of noise and their health effects was also undertaken to inform the approach to the quantitative case studies and the CBA.

The specific methodology used to carry out (i) the second implementation review and (ii) the evaluation of the END are outlined in further detail in Sections 2 and 3 respectively.

The table below provides an overview of the interviews carried out by type of stakeholder. There inevitably are overlaps between some of the categories, e.g. a competent authority at national level may also be in charge of noise mapping and / or action planning for a specific type of transport infrastructure.

[31] http://ec.europa.eu/environment/noise/evaluation_en.htm

Table 1.3 – Overview of interviews by stakeholder type (total: 106)[32]

Stakeholder type	Number
Academic experts	4
Civil society organisations	7
Competent authorities (national)	30
Competent authorities (regional)	12
Consultancies	13
EU and international industry associations	8
EC officials (MOVE, GROW, the JRC)	3
Public authorities* (general)	7
Public authorities (agglomeration)	7
Public authorities (rail)	6
Public authorities (roads)	6
Other	3
Total	**106**

*Note * – it should be noted that a distinction is made between CAs designated under Art. 4 of the END, and wider public authorities that are involved in assisting CAs, for instance, in the provision of input data by local authorities to facilitate strategic noise mapping, or the bodies that assist CAs in advising on prioritisation and measure identification.*

In order to ensure that stakeholder organisations not part of the interview programme were also able to provide their views, questionnaires were made available via an **online survey**. In total, 73 valid responses were received from public authorities, 7 from consultancies involved in strategic noise mapping, and 10 from NGOs/community groups. Whereas the responses to the online survey from public authorities were sufficient to allow for a quantitative analysis, the responses from acoustics consultancies and from NGOs/community groups were analysed qualitatively due to the low number of responses.

The feedback received was helpful in the identification of the outstanding challenges in END implementation and in cross-checking and corroborating the findings from the interview programme. It was especially relevant for certain issues covered through the second implementation review, such as whether any problems were encountered in relation to definitions, and the key challenges relating to noise mapping and action planning.

[32] Including written responses received

2. IMPLEMENTATION REVIEW

This section presents the analysis of the research findings of the second implementation review of the END. Following a description of objectives, scope, and methodology of the review, the research findings and conclusions are presented at EU aggregate level.

2.1 Introduction, Objectives and Scope

Art. 11 of the END (Directive 2002/49/EC) requires a review of its implementation to be carried out once every five years. The first implementation review was published in 2011, and covered the 2002-2009 implementation period. This was carried out by an external contractor, which contained an EU-level synthesis assessment and 27 country reports. Based on this study, the European Commission published a Report[33].

The specific approach to the second implementation review is now outlined.

2.1.1 Objectives of the second implementation review

The formal objectives of the second implementation review of the END are to:

- Critically assess the legal and administrative implementation of the Directive and its key provisions across EU-28 and by MS; and to
- Identify the main difficulties experienced by MS and CAs in implementing these key provisions, and highlight best practices showing how implementation can be improved.

The purpose of presenting the evolution in implementation between Rounds 1 and 2 (hereafter "R1" & "R2") is to determine the extent to which key issues, challenges and problems identified by the first legal implementation review during the early stages of the Directive's implementation have remained problematic in R2, and the nature and extent of remedial actions taken to address them.

2.1.2 Implementation mechanisms

In order to achieve the objective of bringing about a common approach "intended to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise, there are three main actions required from Member States, as defined in Art. 1(1) of the Directive, namely to:

a. Determine the noise exposure of the population through noise mapping;

b. Make information on environmental noise and its effects available to the public;

c. Establish Noise Action Plans based on the results of noise mapping.

The Directive's implementation is therefore centred on the preparation of **Strategic Noise Maps (SNM) and the development of Noise Action Plans (NAP).**

[33]COM (2011) 321 final of 1st June 2011, http://eur-lex.europa.eu/legal-content/EN/TXT/DOC/?uri=CELEX:52011DC0321&from=EN

2.1.3 Scope

The first implementation report covered the initial period of implementation of the END up until 2010. However, this was only mid-way through the first five yearly END implementation cycle, therefore although the second implementation review focuses mainly on R2 implementation, it also covers the latter part of R1. In particular, it examines how the implementation situation has evolved between R1 and R2. Whilst Section 2.3 contains the EU-level synthesis assessment for the second implementation review (supported by EU aggregate data), the 28 country reports developed as part of the full implementation report are provided in a separate, standalone document.

The scope of the second implementation review covers the following six topics:

- Topic 1: Designation of agglomerations, major roads, major railways and major airports;
- Topic 2: Competent authorities and bodies responsible for implementing the Directive, including availability to the public of this information;
- Topic 3: Noise limits and targets and their implementation;
- Topic 4: Definition, delimitation and protection of quiet areas in agglomerations and open country;
- Topic 5: Strategic noise mapping; and
- Topic 6: Noise action planning.

Whilst Topics 1, 2, 4, 5 and 6 directly relate to the implementation of the END, Topic 3 provides an examination of the situation at national level in relation to whether binding or non-binding limit values ("LVs") have been put in place. Although there are no common EU noise limit values in the END, feedback on the interplay between national noise LVs and the effectiveness of END implementation is relevant. For instance, some EU MS use exceedance of LVs as the basis for prioritising measures through action planning. Moreover, at the validation workshop (23rd September 2015), participants expressed interest in sharing benchmarking data on different approaches to setting national limit value across the EU.

2.2 Methodology

2.2.1 Information and data sources

A number of methods and data sources were used in order to carry out the analysis for the second implementation review, such as desk research to analyse relevant data on END implementation, interviews with the nominated national CA in each MS and the validation workshop, which also provided useful feedback on the implementation part. The approach to the different research methods for data gathering and analysis are now examined in further detail.

An **interview programme** was carried out with at least one designated member from the national CA in each MS and with other CAs involved in END implementation. Although CAs provided valuable information, in order to inform the finalisation of the country fiches, it was sometimes necessary to gather supplementary information and to help cross-check the information and data provided. Several complementary interviews were therefore carried out in most MS to obtain further feedback. A number of national road and railway authorities, local and regional authorities and infrastructure operators were interviewed in order to obtain supplementary information on different aspects of implementation at national, regional and local levels.

Following the development of a first draft of each country report, the nominated person from each CA was then asked to clarify any outstanding issues and to provide their formal sign off of the country report.

To supplement the interview programme, and to confirm the preliminary research findings, a **validation workshop** was held on 23rd September 2015 in Brussels with 70 key stakeholders including national CAs. This included a dedicated session covering the findings from this implementation review. Opinions and statements voiced at the workshop are analysed in conjunction with the interview feedback.

An **online survey** was also carried out with different categories of stakeholders. 73 valid questionnaire responses were received from public authorities, 7 from consultancies involved in strategic noise mapping, and 10 from NGOs/community groups and industry associations. The feedback received was helpful for the identification of implementation challenges and subsequently to corroborate the more detailed research findings on implementation that emerged from the interviews. Due to the limited number of responses from consultancies and NGOs/community groups and industry associations, these responses were only analysed in a qualitative manner whereas all aggregate survey findings reported in this and subsequent sections refer to the 73 responses from public authorities.

The online survey was especially relevant to allow for a quantitative analysis of certain issues covered through the second implementation review, such as the extent to which implementation issues were encountered by public authorities, the key outstanding challenges relating to noise mapping and action planning and whether measures were taken to address problems identified in the first implementation review.

28 country reports have been developed to inform the carrying out of an EU-level aggregate analysis of the situation in respect of END implementation. The country reports focus on updating the earlier country reports to highlight any changes that have emerged in the past five years of implementation. They also compare how the situation has evolved between R1 and R2.

The following tools and sources were used to inform the development of country reports:

- The first implementation review from 2010-2011 and the 27 country reports developed to support this review. These however only covered the initial period of R1 implementation (2008-2010) rather than the full five-year cycle;
- National guidelines on Strategic Noise Mapping and Noise Action Planning;
- National legislative texts;
- Any evaluation or similar materials that highlight the lessons learned from R1 implementation; and.
- Verification and supplementary interviews with national CAs as described above.

As part of the data collection exercise for the country reports, data was received from national authorities on:

- Strategic Noise Maps ("SNMs") – overall numbers (received for 28 MS), methodologies and public consultations (received for 21 MS).
- Noise Action Plans ("NAPs") – overall numbers (received for 25 MS), methodologies (received for 18 MS), measures (received for 19 MS), and public consultations (received for 18 MS).

The country reports also include an analysis of issues at subnational level in those MS which have adopted a decentralised approach to implementing the END (also see Section 3). In addition, and to complement the country reports, the following data sources were utilised:

- Data from the EEA's Noise in Europe report, 2014[34]
- EEA data on SNMs, where the most recent data cut-off was 30th June 2015[35];
- Data on the number of NAPs available through the EIONET database and individual country reports (cross-checked and updated during interviews);
- Data provided by national CAs on the number of SNMs and NAPs completed and submitted to the EC, respectively (see 2.2.2 below).

2.2.2 Data on reporting completeness

Data on reporting completeness was obtained from the EEA on SNMs and from the EC on NAPs. The purpose was to analyse the extent to which Member States have reported the information that they were meant to report in respect of R1 and R2 implementation. In particular, the following data sources are analysed in this report:

- Data completeness in respect of the SNMs – data provided by the EEA on the percentage of SNMs that have been submitted by EU MS to the EC in respect of R1 and R2 compared with what was meant to be submitted.
- Data on the number of NAPs submitted to the EC through EIONET. This data has a few caveats: (1) they focus on R2 only; (2) the database on reporting completeness does not distinguish in the 'not submitted' category between NAPs that are available in draft at MS level and those that are still undergoing public consultation and (3) data for agglomerations, roads and railways could not yet be assessed for completeness for France; data for roads and railways not for Germany. No data is available for Greece.

Data reported by the EU MS to the EC has been analysed to assess its completeness because this sheds light on whether MS are complying with the requirement in Art. 10 (*Collection and publication of data by MS and the EC*) to submit reporting data within six months of the dates laid down in Art. 7 and 8 of the END, respectively. In turn, this has helped to check the state of play in implementation and to identify any specific implementation problems remaining now that the definitive, rather than the transitional END thresholds foreseen in the Directive have been implemented in R2. The data and information provided on the extent of completeness of reporting data on SNMs and NAPs has also been useful for assessing how far the EC's reporting responsibilities under Art. 11 have been impeded by the late submission by some MS in both R1 and R2 of reporting data.

In addition, in order to cross-check the data, the study team has collected data on the number of SNMs and NAPs submitted to the EC / EEA at MS level. This was collected through a bottom-up data collection exercise by contacting the CAs as part of the preparation of country reports. In the case of agglomerations, major roads and major railways, data was also collected on the change in the volume of mapping between R1 and R2 due to the transition to the definitive END thresholds. This useful contextual information is provided in the country reports.

[34] http://www.eea.europa.eu/publications/noise-in-europe-2014

[35] The most recently available R2 data is from 30th June 2015 - http://forum.eionet.europa.eu/etc-sia-consortium/library/noise_database/end_df4_df8_results_2012_150630

It was pointed out by various stakeholders during the research that comparing the total *number* of SNMs and NAPs between Rounds and MS may not be meaningful because very different implementation approaches have been adopted in different MS, reflecting the subsidiarity principle. For instance, a single noise map may be prepared for a whole agglomeration in some MS, whilst in others, multiple SNMs may be prepared for a similar sized agglomeration. Similarly, in the case of major roads and major railways, data on the total number of kilometres that have been mapped and crucially how this has evolved between R1 and R2 is more useful than the number of SNMs produced.

Under subsidiarity, some MS have implemented the END on a centralised, whereas others have implemented the Directive on a decentralised basis. There are also MS where a combination of centralised and decentralised approaches has been adopted, depending on the source. Some countries may have defined the entire major roads network as a single map whereas others may produce many different noise maps specific to particular stretches of road. Therefore, the number of SNMs and NAPs will vary widely. In MS where a centralised approach has been adopted, there are considerably fewer SNMs (and sometimes also NAPs), but for instance a single SNM may cover a very large area and the maps may be used to inform a number of different NAPs.

2.2.3 Scale and scope of END implementation

The definitive thresholds envisaged for the END are set out in Art. 3 (definitions). However, the EU legislators foresaw a 2-stage implementation of the Directive, with an evolution in thresholds for when an entity falls within the scope of the END between R1 of implementation in 2007-2012 (the transitional phase) and R2 and subsequent rounds (the definitive phase of implementation), as outlined in the table below.

Table 2.1 – Applicability of the Environmental Noise Directive in R1 and R2

Type of entity	Round 1 (2007-2012)	Round 2 (2013-2018) and thresholds for subsequent rounds
Agglomerations	> 250,000 inhabitants	> 100,000 inhabitants
Major airports	Civil airport, designated by the Member State, which has > 50,000 movements per year (a movement being a take-off or a landing)	Civil airport, designated by the Member State, which has > 50,000 movements per year (a movement being a take-off or a landing)
Major roads	> 6 million vehicle passages a year	> 3 million vehicle passages a year
Major railways	> 60,000 train passages per year	> 30,000 train passages per year

Source: CSES review of END legal text.

A key issue examined later in this section is how far the change from the transitional to the definitive thresholds between R1 and R2 has impacted implementation.

2.2.4 Introduction – the role of a clustering approach in the analysis

It is difficult to generalise and group countries together because many different implementation approaches have been adopted across EU-28, reflecting the non-prescriptive approach under the END, which is implemented under subsidiarity. It is nevertheless helpful to analyse the findings based on a **clustering approach that groups together different Member States that share similar characteristics**, such as whether environmental noise legislation was in place prior to the END's adoption or not, the administrative level (e.g. national, regional, local) the national CA has chosen to implement the key actions required under the END, etc.

Given the complexity of the END and the wide differences in implementation between EU countries, rather than grouping countries together based on one variable alone, three different aspects of implementation are instead focused on. This should facilitate an examination as to whether particular trends can be observed or general observations reached about groups of countries. Examples are provided as to the different clustering approaches that might be applied in the following table:

Table 2.2 - Clustering groups of countries to structure the analysis – key parameters

Clustering approach	Description
1 - Clustering by approach to END implementation	A contrast can be made between centralised and decentralised approaches or approaches combining elements of both. Within decentralised countries, a further distinction can be made between regionalised, federalised and localised approaches.
2 – Environmental noise legislation in place prior to the END (or not)	Clustering according to whether particular EU MS had national environmental noise legislation in place prior to the END. 13 EU countries already had noise legislation prior to the END whilst 15 EU countries had no environmental noise legislation in place at national level prior to the END. With respect to those countries that already had such legislation, further sub-groupings could be made depending on the length of time that legislation to tackle noise was in place prior to the END e.g. <5 years, <10 years, 10-20 years, >20 years, etc.
3 – Clustering by approach to the implementation of NAPs and the type of noise mitigation, abatement and reduction measures identified in NAPs	There are both differences and commonalities between different EU countries in terms of the types of measures that are most frequently implemented. Countries could be grouped together based on the five most common measure types.

In Section 2.3, some implementation issues have been analysed in a way that takes into account the above analytical framework for grouping countries together wherever similarities (or conversely major differences) in approach have been identified.

In addition, where applicable, further correlations have been established between variables in order to identify any relevant trends and patterns. For instance, the extent to which there are common factors that might explain why some MS have submitted reporting information relating to SNMs and NAPs with a major delay, such as the type of implementation approach.

2.3 EU-level synthesis findings

2.3.1 Legislative transposition

Art. 14 of the END requires "Member States [… to] bring into force the laws, regulations and administrative provisions necessary to comply no later than 18 July 2004". This deadline was extended for those EU MS which joined the EU after this date: (Romania and Bulgaria in 2007 and Croatia (2013)).

The END has been transposed in full in 27 out of 28 EU MS. This represents significant progress compared with the first implementation review, when a number of transposition issues were identified and several MS had not fully transposed the Directive by the due deadline. However, the desk research and interviews suggest that these issues have since been addressed by the MS concerned. In R2, the EC identified that one MS still has shortcomings with regard to the transposition of several END articles, although the MS concerned (Croatia) only acceded to the EU in 2013. A stakeholder in **Latvia** suggested that the recent legislative revisions relating to the transposition of the END mean that the concept of "quiet areas in an agglomeration" is no longer defined in Latvian legislation. However, the relevant CA stated that the concept has been translated more broadly as "quiet area in a populated area", which they stated includes agglomerations.

Given that the Directive has been legally transposed, the main challenges in R2 have largely related to the administrative and organisational challenges of implementing the Directive at national level, and ensuring effective cooperation and coordination rather than relating to legal transposition. However, in a number of MS (**BU, DK, DE, EL, LV, LT, NL, PL** and **RO**), there has been an ongoing process of updating, revising and consolidating national implementing legislation on environmental noise since R1. **Croatia** only acceded to the EU in 2013, and thus did not participate in R1 of END implementation. In **Latvia**, in 2015, there was a legal codification exercise to consolidate all existing legislation on environmental noise into a single legal act, which brings together both the legislation transposing the END and wider legislation relating to environmental noise, such as nuisance noise.

2.3.2 Pre-existing legislation on environmental noise

As part of the assessment of the implementation situation across EU-28, Member States were asked whether they had noise legislation in place prior to the introduction of the END in 2002. The findings suggest that 13 Member States already had noise legislation at the national level before the END was adopted. The MS concerned (in alphabetical order) are: **CZ, DK, DE, EL, FR**, **HU, IE, IT**, **LU, PT**, **SE, SK**[36] and the **UK.** In addition, **Lithuania** had some limit values set for noise during the Soviet period, but no comprehensive legislation.

[36] Guidance, even if not binding legislation

In some cases, existing national legislation was longstanding, such as **Luxembourg** and the **UK,** which have had environmental noise legislation since the 1970s, **Denmark** since the 1980s and then a series of countries in the 1990s, such as **France, Greece, Ireland** and **Italy. Portugal** has had legislation pre-dating the END since 2000. These countries also transposed the END into national legislation, either by developing new legislation or by amending an existing body of regulation.

Nevertheless, these findings suggest that in an estimated **15 Member States, the END was the first piece of national legislation specifically designed to address the problem of (environmental) noise.**

2.3.3 Competent authorities

Art. 4 of the Directive stipulates that "Member States shall designate at the appropriate levels the competent authorities […] for implementing this Directive". The EU MS are therefore responsible for determining what levels of administration are appropriate for carrying out the different actions required under Art. 1a, 1b and 1c of the END. They are also responsible for specifically allocating responsibilities for approving SNMs and NAPs under Art. 4(1a) and for collecting them under Art. 4(1b).

MS have generally assigned an environmental-related Ministry or public agency as the national CA for END-related communication and reporting activities to the EC. In a small number of countries, such as **Lithuania** and the **Slovak Republic**, the national CA has been designated with the Ministry of Health.

It is possible to categorise different EU MS according to the way in which they have organised the preparation of SNMs and NAPs between centralised and decentralised approaches, as shown in the table below.

Table 2.3 – Clustering by overall approach to END implementation.

Approach to END implementation	Member States
Centralised	BG, HR, CY, DK, EE, FI, EL, HU, IE, LT, LV, LU, MT, PL, RO, SE, SI, SK
Combination of centralised and decentralised approaches[37]	AT, CZ, PT[38], ES, FR, UK
Decentralised/regionalised	BE, DE, IT, NL (from 2018, the NL system will become further decentralised)

Source: own research, 28 country reports.

Many MS have adopted a more centralised approach to implementing the END. This includes designating CAs for noise mapping, action planning and other implementation activities at national level, with the exception of agglomerations which generally see at least some involvement of local authorities (with the exception of **Austria** where these are dealt with by regional authorities and the **UK** where these are dealt with either by national ministers or by the authorities responsible for the three transport modes).

[37] A mix of national *and* regional implementing legislation and/ or shared responsibilities for END implementation between the national, regional and / or local levels

[38] Nationally centralised implementation with exception of the Azores region who passed independent legislation.

Many small MS such as the **Baltic countries**, **Cyprus**, **Denmark**, **Slovenia**, etc., have adopted a relatively centralised approach but many local municipalities are still involved in mapping and action planning activities in all those countries with a more centralised approach.

The categorisation refers to the *overall* approach, i.e. in countries with a centralised approach, national ministries retain control over the coordination of work for all transport modes, as well as agglomerations even if responsibility for mapping within agglomerations may be delegated to the local municipality. In countries that have elements of both a centralised and a decentralised approach, some END-related competencies have been delegated to the regional level, for instance in **Belgium,** where responsibility for implementing the END lies entirely at regional/subnational level i.e. with the regions of Brussels, Flanders and Wallonia.

The **UK** is an example of a country which combines elements of both a centralised and a decentralised approach. Whilst the Department for Environment, Defra, plays a coordinating role at national level, END implementation overall in the UK also has strong elements of decentralisation, with five different sets of regulations for **England, Wales, Scotland, Northern Ireland** and **Gibraltar** respectively and each country is responsible for producing its own action plans and maps. Therefore, since the Devolved Administrations (DAs) play a lead role in coordinating implementation (with their own set of relevant stakeholders), overall, the implementation system cannot be characterised as centralised.

Within each of the five jurisdictions, implementation is not fully centralised either. In common with other countries, other actors are involved at national and regional level. In **England,** for instance, under Defra's overall coordination, some aspects of implementation, such as noise mapping and action planning, take place at a centralised level, but broader relevant actors at national level also input directly into the process. For instance, in the case of major roads, the Department of Transport and Highways England were involved in the development of a national action plan, and a single major roads NAP was prepared under Defra's coordination. In agglomerations, although the approach is again quite centralised, with Defra playing the lead role, local authorities are involved in the process of the development of SNMs and NAPs.

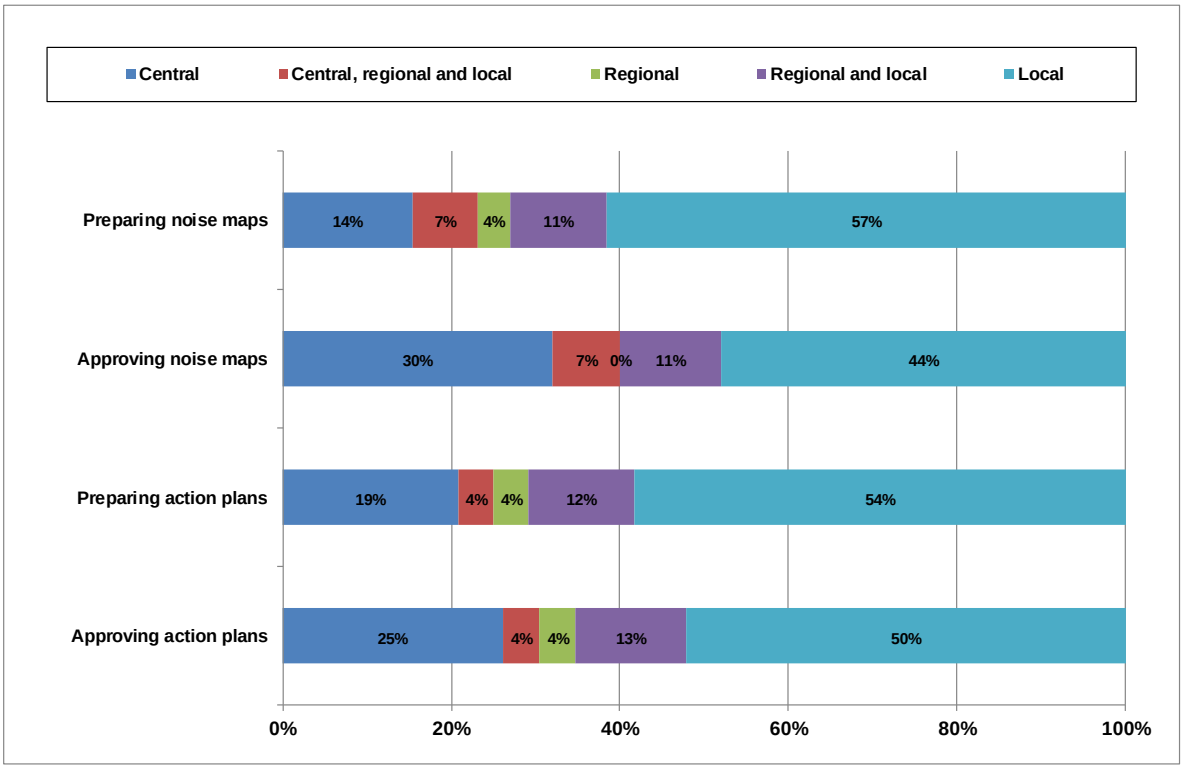
Some Member States have implemented the END in a way that reflects their prevailing administrative structures more broadly. For instance, **Germany** and **Austria** implement the END according to their federalised administrative structures, although in the former, there is a strong element of further decentralisation from the Länder to the local level. **Spain** and **Italy** have a strongly regionalised administrative structure generally, so have implemented the END in a way that is broadly decentralised, although national CAs continue to play a key role in some aspects of implementation e.g. major railways and major roads.

It should be stressed that whilst the approach to END implementation often reflects different prevailing traditions in national administrative systems, this is not always the case. Some countries may conversely have a relatively centralised or decentralised administrative system generally, but have chosen to implement the END differently. For instance, contrary to its traditionally centralised administrative structure, **France** has adopted a strongly decentralised approach where state representatives in each of the 96 *départements* are responsible for the designation of sites, the preparation of noise maps and drafting of action plans for major roads and major railways and the designation of the municipal bodies responsible for mapping and action planning within agglomerations. In the **Netherlands,** whilst some laws are implemented on a more centralised basis, reflecting national administrative structures, the END is implemented on a strongly decentralised basis.

Whilst recognising that different countries have adopted a more centralised or a decentralised approach overall, it should be strongly emphasised that **END implementation arrangements are also strongly linked to the transport source in question**. For instance, in almost all EU Member States (an exception being England within the UK, SNMs and NAPs for agglomerations are drawn up on a localised basis. Conversely, in the case of major railways and major roads, national railway authorities and national road authorities often play a significant role in noise mapping and in action planning, often (but not always) in a CA capacity.

The patterns that can be identified in implementation structures are now analysed further, distinguishing **between agglomerations and by mode of transport.** The END specifies that **agglomerations** with more than 100,000 inhabitants fall within scope. There were 495 such agglomerations in EU-28 in 2015. Within each agglomeration, SNMs covering the different sources of noise (*roads, railways, airports* and *industry*) need to be produced and NAPs drawn up. The approach to implementation for agglomerations differs between EU MS depending in part on whether agglomerations are a nationally-recognised administrative term and level or not. At an EU aggregate level, the preparation of NAPs for agglomerations is largely undertaken by local authorities (57% or 16 MS), which also play a prominent role in approving SNMs (44% - 12 MS), and in preparing (54% - 14 MS) and approving (50% - 12 MS) action plans (see figure below). Unsurprisingly, national authorities play a more prominent role in approving SNMs and NAPs for agglomerations than in preparing them.

Figure 2.1 – Overall EU Profile of contributors to Noise Mapping and Action Planning – Agglomerations (% of n=28 MS)



Source: bottom-up feedback collected from the Member States, as presented in the 28 country reports

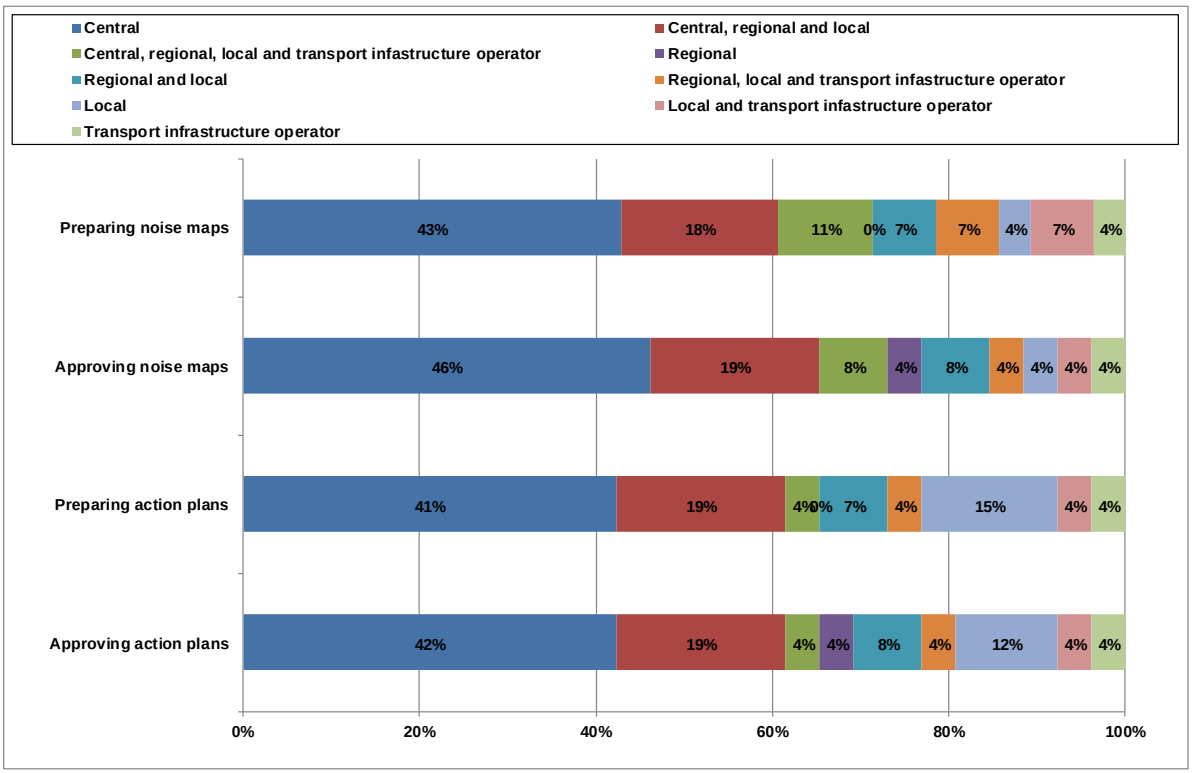
In some MS, such as **Italy,** even when mapping and action planning for ***agglomerations*** is carried out by local authorities, regional and provincial authorities still play an important coordination role and assume responsibility for collating data for EU reporting purposes.

The END also provides that **major roads (outside agglomerations)** with traffic higher than 3 million vehicles per year are within scope. In R2, this affected 154,738 km of roads in the EU-28. A distinction needs to be made for major roads between those located *within* and *outside* agglomerations. Whereas noise mapping and/or action planning activities for major roads within agglomerations are often dealt with by local authorities directly within the agglomerations, major roads outside agglomerations are often administered by National Road Authorities (NRAs) at central level on a country-wide basis.

More generally, the implementation approach was partly dependent on how road networks are organised in each country. The table below illustrated the administrative responsibilities for noise mapping and action planning for major roads outside agglomerations. *Central* signifies that *only* central authorities are responsible (e.g. in 43% of MS, central authorities have exclusive responsibility for preparing noise maps for major roads outside of agglomerations), whereas *regional* signifies that *only* regional authorities bear responsibility, and *local* indicates that *only* local authorities are responsible.

As the table shows, in close to half of EU MS, noise mapping and action planning are carried out at a central level for major roads. In those countries where a combination of national, regional and/or local authorities are involved, there is generally a division of labour in which national authorities produce the SNMs and NAPs for major roads *outside* agglomerations whereas local authorities produce SNMs and NAPs for major roads *within* agglomerations. In some cases, roads are administered by private sector operators who often also produce the SNMs and NAPs, even if public authorities may be responsible for approving them.

Figure 2.2 - Overall profile of contributors to Noise Mapping and Action Planning – Major roads outside of agglomerations (% of n=28 MS)

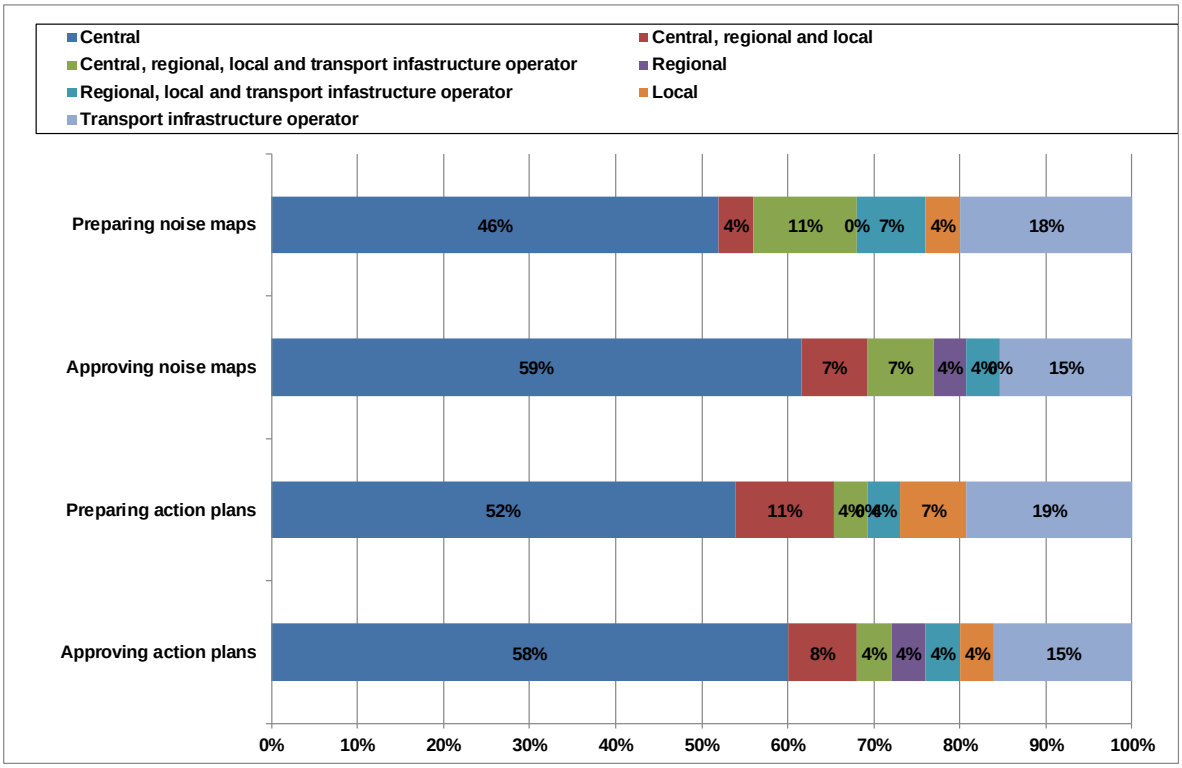


Source: bottom-up feedback collected from the Member States, as presented in the 28 country reports

In most EU countries, National Road Authorities (NRAs)[39] played a key role in noise mapping in both R1 and R2. A national CA is then commonly responsible for providing for the approval of road NAPs. Local authorities are also involved in mapping roads located within their agglomeration, but are often dependent on NRAs for mapping major roads within their agglomeration and for roads bordering the agglomeration. Regional bodies also play an important role. For instance, in **France,** roads are a state competence, but road NAPs have been prepared at a departmental level. In **Ireland,** the NRA is responsible for noise mapping but not action planning. It has provided road mapping of major roads not only outside agglomerations but has also assisted local and city authorities in preparing SNMs in agglomerations. In **England**, although the NRA, Highways England, does not have direct responsibility for preparing noise action plans, it works very closely with the Department for Transport and with Defra, the overall lead for END implementation.

Major railways (outside agglomerations) with more than 30,000 train passages per year are included in the END. In R2, the scope covered 72,341 km of rail across EU-28. Railways-related Noise Mapping and Action Planning activities are run by national authorities in many countries. In some EU MS, Ministries of Transport and their equivalent are closely involved (e.g. the UK but working in close conjunction with the private railway infrastructure manager), whereas in other MS, the state railways take the lead role as the CA, at least for noise mapping (e.g. **Ireland** and **Italy**).While the preparation of NAPs and SNMs for major rail is often carried out at a subnational or at several administrative levels, or by different infrastructure operators, national authorities have responsibility for approving NAPs in 59% of Member States for SNMs and in 58% of EU MS in the case of NAPs.

Figure 2.3 – Overall EU Profile of contributors to Noise Mapping and Action Planning – Major railways (% of n=28 MS)



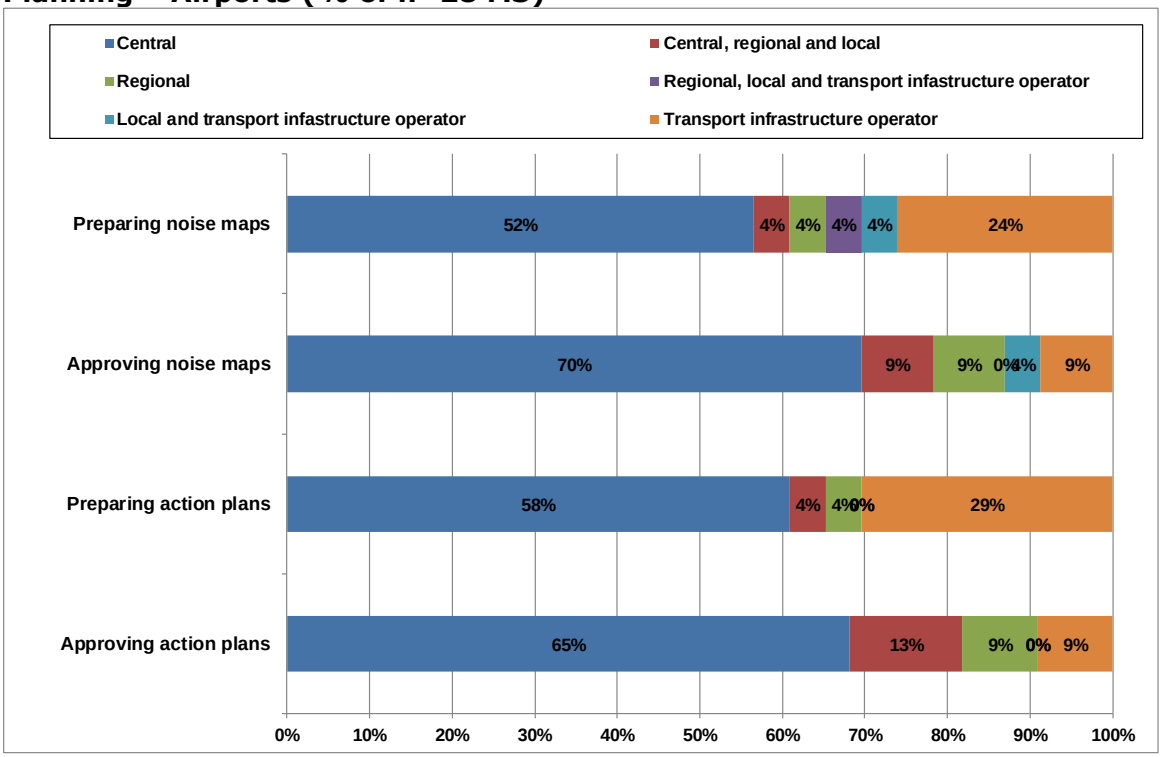
Source: bottom-up feedback collected from the Member States, as presented in the 28 country reports

[39] See for instance the END and NRAs – Final Summary Report CEDR Road Noise 2009-2013

Finally, **major airports** are defined in the END as airports with more than 50,000 aircraft movements (take-offs and landings) per year. There were 92 airports that met this criterion in R2. Airports are often located within or in vicinity to agglomerations, and aircraft noise is therefore one of the sources of noise to be addressed within agglomerations. This means that at times, local authorities and airport operators are both involved in END implementation with regard to airports and noise from aircraft.

Airport operators (both state-owned and private sector) in some EU countries play a major role in the preparation of SNMs and NAPs and in the implementation of measures identified in NAPs. However, in the majority of Member States, SNMs and NAPs are produced by national authorities. In some countries, airport infrastructure is privately owned (e.g. **DK, IE** and the **UK**) while in others it remains managed by the public sector (e.g. **FR, LT**). In other countries, the situation can be more complex, when there is a combination of privately owned and state-owned airports. In addition, many national authorities, such as Ministries of Transport, play a role in approving NAPs for airports.

Figure 2.4 – Overall EU Profile of contributors to Noise Mapping and Action Planning – Airports (% of n=28 MS)



Source: bottom-up feedback collected from the Member States, as presented in the 28 country reports

A few **specific implementation issues** were highlighted with regard to the designation of CAs and administrative arrangements for implementing the END:

- Several stakeholders mentioned that whilst overall responsibility for implementing the END lies at national level, action planning is often carried out by organisations at local level. Whilst this may raise issues related to accountability for END implementation. Many stakeholders pointed out that noise at receptor could best be tackled through a local level approach.
- In some MS, stakeholders perceived there to be insufficient communication between CAs in charge of action planning at national level and organisations on the ground that actually have to implement measures foreseen in NAPs. This may in part be explained by a fragmented approach to END implementation and a lack of

coordination between the different CAs and other public authorities (such as those involved in the provision of information and data for SNMs and NAPs).

- In the case of roads and railways, it was pointed out by some stakeholders that it may be better to carry out noise mapping on a centralised basis but action planning on a decentralised basis. This was seen as being a means of avoiding over-fragmentation of noise mapping.

Overall, there do not generally appear to be problems with the procedures for the designation of CAs. Member States have adopted different approaches in terms of the administrative level at which CAs have been designated (national, regional and local), often reflecting their general administrative arrangements and traditions. Whilst the designation itself does not appear to have caused problems, in countries that have a strongly decentralised approach, there have sometimes been practical implementation difficulties, such as ensuring coordination when there are many different CAs involved in END implementation at different administrative levels.

2.3.4 The designation and delimitation of agglomerations, major roads, major railways and major airports

The preliminary thresholds used for determining which entities fall within the scope of the END in R1 as specified under Art. 7 and Art. 8 differ from the definitive thresholds used under Art. 3 (see Table 2.1 – Applicability of the Environmental Noise Directive in R1 and R2). The use of the definitive thresholds in R2 had a major impact on the number of agglomerations covered by the END and the amount of mapping required for roads and railways. The table below presents the numbers of agglomerations, airports and km of roads and rail designated in R1 and R2 and the magnitude of the increases in scale and scope of mapping activities:

Table 2.4 – Designations in Round 1 and Round 2 (Strategic Noise Mapping)

EU28	Round 1	Round 2	Increase by (%)
Agglomerations	176	467	165
Airports	73	92	26
Rail (km)	31,576	72,341	129
Road (km)	67,488	154,738	129

Source: EEA data, supplemented by bottom-up feedback collected from the MS

The definitive END thresholds used in R2 are 50% lower for major roads and major railways compared with the transitional thresholds used in R1. This led to a significant increase in the number of kilometres (km) of major roads and major railways that had to be mapped (by 129% in each case). For agglomerations, the change in thresholds between R1 and R2 from >250,000 to >100,000 people led to an increase in the number of agglomerations by 165%.

Since the threshold for airports did not change between Rounds, there was only a moderate increase (26%) in the number of airports that had more than 50,000 movements per year. This may be explained by changes in airport traffic movement data.

The increase in the scope of END coverage in R2 affected most Member States. Those countries that experienced particularly strong increases in coverage between Rounds often had a low R1 baseline in terms of mapping requirements. A number of examples are provided below to illustrate the effects on the volume of noise mapping involved

due to moving from the transitional to the definitive thresholds of the END in terms of the corresponding increase in coverage between R2 and R1:

- In **Austria,** whereas in R1 only one agglomeration was mapped, in R2, this increased to 6. In **Lithuania**, the corresponding figures were 2 in R1 and 5 in R2.
- In Ireland, there was an increase of 24 times the number of km of major rail that had to be mapped (from 8 to 189) and an increase of 15 times the amount of km of major roads within scope (564km to 8294 km).
- In **Bulgaria**, there were 12 times the amount of km of major roads covered (89km to 1044 km)
- In **Hungary**, there was an increase of 37 times the amount of km of major rail covered (25 km to 914 km)

In the table below, examples of changes in END scope between Round 1 and 2 of more than 5 times are illustrated.

Table 2.5 - Changes in END scope between Round 1 and 2 of more than 5 times

	AT	BG	EE	FI	FR	EL	HU	IE	LT	PL	RO	SE
Agglomerations				7		7	9					
Airports	6											
Rail					7		37	24		18		
Road		12	22	12				15	7	10	12	6

Source: own research, 28 country reports

Although the transition to the definitive END threshold was envisaged from the outset in the legislation itself, it is important to note the evolution in the scale and scope of noise mapping activity since according to some stakeholders, this may partially explain why there were greater delays in R2 than in R1, as will be shown in Section 2.3.7.

This second implementation review has identified a range of **implementation challenges** faced in Member States in delimitating agglomerations, roads, railways and airports for END implementation, such as:

- There seems to be a lack of clarity around the definition of, and the delimiting method to be used for, agglomerations (identified as a challenge in 5 Member States- BE, FR, IT, LV, UK)
  - In FR, the definition of agglomeration has caused difficulties. 60 agglomerations including 1,500 '*communes*' are considered as falling within the scope of the Directive. Some might argue that France 'over-transposed' the Directive in designating agglomerations.
  - In IT, while sometimes an agglomeration is synonymous with the delimitations of a city, in other instances, several agglomerations make up one city. This creates confusion among stakeholders as to what constitutes an agglomeration;
- Complex administrative arrangements and the non-transparent division of competencies between different actors at local, regional and national levels slowed down the process of designation and delimitation, potentially causing delays in noise mapping as well (6 Member States – AT, ES, FR, HU, IE, IT);

- There was (initial) confusion among CAs with regard to the designation of administrative responsibilities for quiet areas within agglomerations (3 Member States – LT, NL, RO);
- The definition of major roads was not always easy to reconcile with national practice (e.g. DK, and in EE where the threshold of 3 million vehicles per year is not directly in line with the national definition of a major road);
- In DE, annoyance is defined differently in different agglomerations with some going beyond the requirements in the END in terms of the scope of roads that are included in the noise mapping process, limiting data comparability in the country.

2.3.5 Noise limits and targets

The END does not set any noise limit values ("LVs") at EU level at receptor, but rather under the subsidiarity principle relies on Member States to consider whether national limit values are required and to define appropriate national LVs for the determination of noise levels. It is left to Member States' discretion to determine these in general and with regard to quiet areas in agglomerations (Recital 8 of the END). Nevertheless, if Member States do chose to set limit values, they are required under Art. 5 to inform the Commission.

The discretion provided to Member States means that a range of policies may be adopted with regard to noise limits. A distinction should be made between **binding and non-binding noise LVs.** Whilst binding LVs are statutory limits, non-binding LVs are aspirational targets that may be used in guidance documents and to help identify priorities for noise action planning. Noise limits may be set for planning purposes, i.e. only forward-looking, or also for existing infrastructures or installations.

Noise limits also differ depending on whether they are measured indoors or outdoors, and for single transport sources or for the cumulative effects across several sources. It was observed by acousticians within the study team that the impact that noise LVs or targets may have in practice also very much depends on the level at which they are set. For instance, unambitious levels may not have any impact, whereas very ambitious levels could potentially produce a backlash amongst stakeholders or have unintended consequences. Moreover, levels that are not clearly linked to existing research (e.g. the WHO health-based assessments) on noise impacts may be less accepted amongst authorities, developers and other stakeholders.

The first implementation review report highlighted that **most MS (21) had set noise "LVs" which were legally enforced** and whose transgression should in theory have led to measures to control noise and/or insulate exposed populations, and/or in some MS, the imposition of penalties on those responsible for the source. In practice, SNMs revealed that their transgression neither led to measures being implemented nor any specific action being taken, although they did inform NAPs in those MS.

In the table on the following page, the updated situation in respect of binding (albeit not necessarily enforced) noise LVs is provided. The situation has not changed greatly from the first implementation report from 2011, with the exception that Croatia has now become an EU member and has also adopted national LVs.

Table 2.6 – Noise limit values in the EU-28 – second implementation review

	Noise Limit Values in force	Guidance / indicative values	Noise trigger values for action
AT	X		
BE	X		
BG	X		
CY	X		
CZ	X		
DE	X		X
DK	X	X	
EE	X		
EL	X		
ES	X		
FI		X	
FR	X		
HR	X		
HU		X	X
IE		X	
IT	X		
LT	X		
LU	X		X
LV	X		
MT	--	--	--
NL	X		
PL	X		
PT	X		
RO	X		
SE		X	
SI	X		
SK	X		
UK		X	

Source: bottom-up feedback collected from the MS through 28 country reports. Note – each cross indicates an instance where the MS has a particular type of LV (e.g. binding, non-binding). Two dashes (e.g. Malta indicate no information available).

In most EU MS, different values have been set for different sources of noise, and for day and night. The strictest limits imposed range from 33-35 dB and relate, for example, to evening noise near hospitals and recreational areas (BG, DE, LU), special protected areas (IT) whereas the highest levels relate range from 70-75 dB, for example for rail noise during the day (FR) and for heavy industry during the day. Responses from CAs in relation to implementation challenges in R2 indicated that few changes have been made by MS to strengthen the enforcement of noise LVs since the first implementation review.

The research found that, as already identified in the first implementation review, there remains a problem with regard to the lack of enforcement of national LVs. Among the 75% of MS that have noise limits, less than 25% were able to categorically confirm that LVs were (fully) enforced. Since there are no common mandatory limit values at EU level, MS were not asked to report back systematically as to whether there were any specific implementation challenges in applying national LVs. However, interview feedback indicates that it is sometimes difficult to convince national policy makers in other areas of the importance of enforcing national limit values. Weak enforcement of noise LVs in cases of exceedance was a recurring theme raised by END stakeholders in many EU MS.

The putting in place of national LVs was however found to have assisted in END implementation. For instance, the exceedance of LVs was often used as a starting point for prioritising interventions to mitigate or reduce noise through action planning and through policies more generally, such as in **Austria** (modernisation of railways), **Belgium** (airline accountability), **Croatia, Czech Republic, Denmark, Slovakia** (construction of new roads), **Germany, Hungary, Ireland, Latvia, Luxembourg, Netherlands** (noise zoning and abatement); **Slovakia, Slovenia** and in the **UK** (determining eligibility for façade sound insulation, planning).

2.3.6 Definition, delimitation and protection of quiet areas

Introduction

Before analysing the current state of play in respect of the implementation of quiet areas, it is necessary to examine the treatment of quiet areas in the text of the Directive.

Quiet areas are mentioned in various parts of the Directive. Recital 8 states that "The concrete figures of any limit values are to be determined by MS, taking into account, *inter alia*, the need to apply the principle of prevention in order to preserve quiet areas in agglomerations". Art. 2 specifies that the END applies "in public parks or other quiet areas in an agglomeration, in quiet areas in open country". Art. 3(l) (definitions) states that *inter alia* "a quiet area in an agglomeration' shall mean an area, delimited by the competent authority", but leaves MS to determine the values that apply. Art. 3(m) 'quiet area in open country' shall mean an area, delimited by the competent authority, that is undisturbed by noise from traffic, industry or recreational activities". Art. 8(1b) stipulates that NAPs should also aim to protect quiet areas in agglomerations. The need for action on quiet areas in open country is left open under Art. 11.

Definitional and interpretation issues

The END leaves **considerable discretion to MS with regard to the delimitation of quiet areas.** Whilst this was welcomed by many stakeholders, there were a number of perceived definitional ambiguities raised by CAs:

- There were differences in interpretation between EU MS as to whether the designation of quiet areas is mandatory, or voluntary under the END. In fact, there is no compulsory requirement to designate quiet areas. However, quiet areas are meant to be part of action plans within agglomerations, which "shall also aim to protect quiet areas against an increase in noise", which may have resulted in different legal interpretations.
- It is unclear in the legal text of the END whether the term 'quiet' should be defined in absolute terms or in relation to surrounding areas. For instance, a quiet area in an agglomeration may not be particularly quiet in absolute terms, but still considered quiet *relative* to its urban environment and thus still deserve attention (mentioned at the validation workshop by several participants).

- The definition of quiet areas in urban areas remains unclear in the view of at least some END stakeholders. This has led to difficulties in determining how quiet areas should be approached in agglomerations (3 Member States– **BE** and **LV**).
- There was a perception of a general lack of clarity regarding the delimitation and protection of quiet areas in open country (**HU, LV).**
- It was also unclear whether quiet areas in agglomerations and open country are mutually exclusive or whether a quiet area in open country can also be delimited within an agglomeration (mentioned by stakeholders in **LT** and in **NL**). This may constitute a problem where agglomerations include both noisy urban areas and in the wider periphery relatively rural areas that could be classified as quiet open areas. However, there is no impediment in the legal text of the END to designating both types of quiet areas within a single agglomeration.

Among the consequences of challenges in arriving at an agreed definition of quiet areas have been:

- Ongoing debate in relation to the definition of quiet areas potentially undermines the consistency of measures to protect such areas. For instance, in **Germany,** quiet areas have been interpreted differently across different Länder and among local municipalities.
- Delays in Member States designating quiet areas under the END, especially in rural areas in open country that have not generally been mapped.
- The country-specific definition and delimitations of quiet areas need to be taken into account when making cross-country comparisons.

Selection criteria for quiet areas and delimitations

The criteria for the delimitation of a quiet area are not specified in the END, and hence neither in the transposing national legislation. Rather, separate guidance documents set out the criteria for selecting, delimiting and designating quiet areas. Despite the limited delimitation of quiet areas, a lot of groundwork has been carried out to define quiet areas between R1 and R2 and to develop appropriate selection criteria (**e.g. in Finland, France, Lithuania** and **Poland)**. However, in many MS, specific values to define a quiet area are determined at the local level.

In **Lithuania,** non-binding guidelines were prepared in 2008 by the former State Environmental Health Centre. Updated guidelines for delimiting quiet areas were incorporated into the non-binding Exemplary Model for the Organization and Implementation of Environmental Noise Prevention in 2012.

In Poland, although a clear definition (supported by selection criteria) has been established for determining quiet areas, no quiet areas have been designated either in R1 or R2. However, 15 potential quiet areas have been identified.

In some EU MS, threshold values have been set as to how to define quite areas, although there is discretion as to how these are applied.

For instance, the Technical Guidelines for Noise Mapping in **Germany** allow CAs discretion to designate quiet areas through action plans. Threshold values of between L_{den} 50 and 55 dB(A) are commonly applied. However, many cities also use a differential value e.g. 6 dB(A) to distinguish the border and inner centre of a quiet area. In some cases, a minimum area size is determined and more quiet areas are often differentiated in categories with regard to noise levels, location, size and accessibility.

In **Poland,** a suggested threshold of >55dB has been adopted, but a number of further criteria have also been determined that have to be taken into account, such as:

- Demographical considerations relating to population density;
- Land use plans with maps for transportation network development;
- Spatial management consideration;
- Guides for future land use planning and spatial management; and
- Prioritising nature preservation areas, especially Nature 2000 areas.

The possible risk of "double designation" of the same geographic areas as a quiet area under the END and as a protected area under the Habitats Directive was mentioned as a problem in the **UK (England).** However, this does not appear to constitute a problem in other EU MS.

Current state of play in implementation

This sub-section looks at the current state of play in terms of *practical* implementation of the Directive with regard to the designation of quiet areas.

To date, the country research found that **13 Member States have designated quiet areas** – an increase compared to R1: **AT, BE, DE, DK, EE, HU, IE, IT, LV, LT, NL, RO** and the **UK** (Scotland and Wales only). However, this means that **the majority of EU Member States had not designated any (END-related) quiet areas by R2.**

In some of the MS that have designated quiet areas, this has only been done to a very limited degree, however. Moreover, in some instances, quiet areas have merely been identified without actually being *formally* designated. To illustrate these differences, the respective situation in a selected number of EU MS is considered below:

- **Belgium:** No quiet areas have been designated based on the END but in Flanders 'rural silent areas' had been designated prior to the END which are now being adapted in line with the END framework.
- **Denmark:** Quiet areas are defined within the municipality action plans. Before the END, Denmark also sought to preserve certain natural areas for their quietness.
- **Estonia:** The number of designated quiet areas has increased from 24 in R1 to 44 in R2.
- **Germany:** Quiet areas have been identified in four major cities/agglomerations, but none have been formally designated.
- **Italy:** In the region of Tuscany, 552 quiet areas have been defined. These appear to relate to very small areas of acoustic quality where it is good. This is different from the way in which quiet areas have been implemented in most EU MS.
- **Latvia:** 36 quiet areas were designated in R1 with a total size of 11.9 km2, none yet in R2.
- **Netherlands:** The total size of quiet areas amounts to 650 hectares, including some wetlands (i.e. quiet areas in open country).
- **Romania:** Parks in agglomerations have been designated quiet areas.
- **UK:** The number of designated quiet areas increased from 41 in R1 to circa 140 in R2.

One MS was identified as intending to designate quiet areas in the near future (**Sweden),** but has not yet formally done so. **Norway**, which implements the END on a voluntary basis, has also designated quiet areas.

The 2014 EEA report[40] on quiet areas was also reviewed to validate the findings against the assessment of quiet areas carried out as part of the country report assessment. This found that 14 MS (**BE, CZ, DE, DK, EE, EL, ES, FR, IE, IT, NL, PL, SE, UK**) had adopted at least some actions relating to quiet areas, primarily in agglomerations. Sound-pressure levels play an important role in almost all of these schemes. The report identifies **Belgium, the Netherlands, Sweden** and the **UK** as the MS with the most developed soundscape approaches. In the **Netherlands**, there were already "protected quiet areas" prior to the adoption of the END in national legislation. However, it remains unclear whether France has actually has designated quiet areas, since evidence was only presented for Lyons in the report and there was no data for France as a whole.

An illustration as to how progress has been made in strengthening attention to quiet areas was identified in **Ireland.** In the Dublin City agglomeration, the number of quiet areas increased from 0 in R1 to 8 in R2 after preparatory work to identify these areas on the basis of appropriate selection criteria had been carried out in R1.

In four Member States, (e.g. **Greece, Hungary, Ireland** and **Latvia**), quiet areas have so far only been defined in agglomerations, but not in open country. In **Germany,** quiet areas in open country are not usually defined either, since relevant areas are not covered through END noise mapping.

Further relevant issues, such as the extent to which there was any overlap with other EU legislation, and possibly explanatory factors for the low numbers of designations of quiet areas are now considered.

In the **UK**, there are no quiet areas in **England,** since there was a concern about the potential double designation of particular areas already designated as protected under the Habitats Directive, which are regarded by the national CA as *de facto* quiet areas even if they have not been designated as such. Quiet areas have however been designated in **Wales** and **Scotland.** In Wales, for instance, in R1, a procedure was developed for the designation of quiet areas in agglomerations and in R2, 63 quiet areas[41] within large urban areas were subsequently designated. This demonstrates that even *within* EU MS, there can be differences in approach and interpretation to implementing quiet areas.

Finland has not designated any quiet areas under the END. However in R1, the city of Helsinki has undertaken some research into quiet areas and quiet areas are likely to be included for Round 3. The concept of "protected quiet areas" existed in national legislation in the **Netherlands** prior to the END's implementation (under the responsibility of the Dutch provinces). Under the END, local authorities are responsible for the designation of quiet areas. Consequently, confusion has arisen between quiet areas under the END and other types of protected areas that can be characterised as being quiet that were already protected under existing national legislation.

A possible explanation for **the slow designation of quiet areas across EU 28** in both R1 and R2 is that it is not clear to Member States whether it is possible to reverse the process, i.e. to 'un-designate' quiet areas once they have been designated. As long as it remains unclear whether that is possible, MS authorities will hesitate to designate quiet areas because of legal implications and possible restrictions in future construction and economic development. Another explanation may be that it is difficult to require municipalities to provide spatial information on quiet areas that have not already been mapped in the absence of national enforcement mechanisms to compel public authorities to designate quiet areas. This was the case for example in **Lithuania.**

[40] EEA Technical Report No 4/2014. Good practice guide on quiet areas.

[41] http://gov.wales/topics/environmentcountryside/epq/noiseandnuisance/environmentalnoise/noisemonitoringmapping/1stroundquietareas/?lang=en

Good practice guidance on quiet areas and their implementation

It is worth summarising the current situation in respect of the availability of good practice guidance on the implementation of quiet areas, since this was mentioned as an important issue by END stakeholders.

According to some stakeholders interviewed, it was unclear what steps ought to be taken once quiet areas have been designated in urban areas, since the END is not prescriptive in this regard. Without follow-up action, it was suggested that the act of designation in itself would not achieve positive change. Stakeholders participating in the workshop also pointed to the need for further guidance from the EC as to how to select, designate and delimit quiet areas and once selected, how to protect designated quiet areas. However, it should be noted that the EEA has already produced a Good Practice Guide[42] on quiet areas in 2014. It appears that not all stakeholders are aware of this guidance.

A number of stakeholders noted that useful research has been undertaken through **FP6, FP7 and the LIFE+ programme into quiet areas in urban areas and into the preservation of acoustic quality where it is good.** Whilst such projects are outside the Directive's scope, they are complementary to the implementation of quiet areas as defined under the END.

In the **Netherlands**, a number of examples of good practices were identified in respect of the identification and implementation of quiet areas and the preservation of acoustic quality where it is good. A stakeholder interviewed provided the following example:

Box 2.1 The QUADMAP Project

The QUADMAP project (Quiet Areas Definition and Management in Action Plans) - http://www.quadmap.eu/- was funded under the EU programme LIFE+. It is concerned with repositioning local noise policy approaches to quiet urban areas. The project aims to develop a harmonized methodology for the selection, assessment and management of quiet urban areas (QUAs). Best practices, lessons learned and empirical study data was assessed in order to define – acoustic and other – parameters relevant for the perception and evaluation of quiet urban areas by EU citizens.

The municipalities of Amsterdam and Rotterdam were involved in the project and undertook measurements to help monitor acoustic quality where it is good.

There have been a number of pan-European projects to promote research into quiet urban areas, such as the QSIDE project, which examined the positive effects of quiet facades and quiet urban areas on traffic noise annoyance and sleep disturbance and the SILENCE project [43](Quieter surface transport in urban areas)[44], both funded under FP7, and the CityHush project (Acoustically Green Road Vehicles and City Areas - (http://www.cityhush.eu/)) supported through FP6.

Besides these European initiatives, at the national level, a few Member States have developed good practice guidance on quiet areas. For instance, in **France,** a National Guide[45] was developed in 2008 which provides a definition of quiet areas and suggested criteria for their creation. It also serves as a "national repository" for information about good practices in respect of quiet areas.

[42] http://www.eea.europa.eu/publications/good-practice-guide-on-quiet-areas

[43] http://ec.europa.eu/research/transport/projects/items/silence_en.htm

[44] http://ec.europa.eu/research/transport/projects/items/qcity_and_silence_eu_projects_target_urban_noise_en.htm

[45] http://www.developpement-durable.gouv.fr/IMG/pdf/Referentiel_national_pour_la_definition_et_la_creation_des_zones_calmes_-_2008-2.pdf

In **Northern Ireland**, draft Guidance[46] on the identification and designation of quiet areas was subject to a recent consultation which closed in November 2015.

Conclusions - quiet areas

A summary of the main implementation challenges with regard to quiet areas in R2 is provided below. This includes issues that remain problematic from R1, as reported by CAs, and the identification of new issues that only emerged in R2.

- There are a number of definitional issues relating to quiet areas that have remained problematic in both R1 and R2 of END implementation, with evidence of different interpretations across the EU;
- It was regarded as especially difficult to identify quiet areas in open country (Art. 2) since these areas (outside agglomerations and often far away from major transport routes) have not been mapped as part of the development of SNMs;
- Although progress has been made at national level in most EU MS in establishing definitions and criteria for the selection of quiet areas since R1, only a small number of MS had actually designated quiet areas midway through R2 implementation;
- The low take-up of protecting the quality of the acoustic environment where it is still good was explained by some stakeholders by stating that it was difficult for public authorities to justify any measures in these areas when there were other areas that population exposure data indicated were a greater priority for the reduction of noise.

2.3.7 Strategic Noise Mapping

Introduction

Strategic noise mapping is a method used to visualise noise pollution in a specified geographic area. According to Art. 3 of the END, it means *'the presentation of data on an existing or predicted noise situation in terms of a noise indicator, indicating breaches of any relevant limit value in force, the number of people affected in a certain area, or the number of dwellings exposed to certain values of a noise indicator in a certain area'.* The END also defines a strategic noise map (SNM) as '*a map designed for the global assessment of noise exposure in a given area due to different noise sources or for overall predictions for such an area'.*

One of the END's objectives is to establish a common approach to assess the exposure to environmental noise throughout the EU. On the basis of indicators of population exposure such as annoyance and sleep disturbance, SNMs have to be produced by Member States according to Art. 7 of the END and updated as required every five years from 2007 onwards. Where relevant, these need to be approved by CAs. SNMs need to be produced for all major roads, railways, airports and agglomerations (the latter requiring several SNMs by individual transport source as well as industrial noise). Annex IV of the END sets out the minimum requirements for strategic noise mapping. Member States are obliged to provide the EC with information from their SNMs at regular intervals. Information is submitted via the Electronic Noise Data Reporting Mechanism.[47]

Two years before the submission deadline for SNMs, MS have to inform the EC in relation to the list of agglomerations for which exposure data has to be submitted by noise source:

[46] https://www.doeni.gov.uk/consultations/consultation-quiet-area-policy-guidance
[47] Noise in Europe Report. 2014. P. 13

- Roads
- Railways
- Aircraft
- Industry

The total number of agglomerations within END scope was 163 in R1 and 468 in R2 for EU-28. Since some agglomerations may not be affected by all sources of data, the total number of agglomerations for which exposure data has to be submitted may differ by source of noise. For example, in R1, data on aircraft noise only had to be submitted for 144 agglomerations since the remaining 19 did not have any relevant aircraft noise.

- The list of major airports for which exposure data has to be submitted; and
- The list of major road and railway segments for which exposure data has to be submitted.

Two years later, exposure data would then be expected to have been submitted by Member States to the EC as announced.

The completeness of Strategic Noise Maps in the EU

The Noise in Europe Report by the EEA from 2014[48] assessed the completeness of SNMs in R1 and R2 based on the gap between (a) the number of SNMs to be developed according to source data provided by the Member States and (b) the number of SNMs actually reported to the EC 8 months later (August 2013). The data was last updated on 30th June 2015 for the EEA by an independent contractor. The table below shows the completeness of data on SNMs by round and noise source as last updated by the ETC/ACM on 30 June 2015. The coverage figures take into account all the mandatory fields to be reported for under the label 'DF4_8 (strategic noise maps dataflow)' except the "Computation and measurement methods report details".

Table 2.7 – Completeness of SNMs – share of number initially envisaged that has actually been reported to the EC[49]

Round	Inside agglomerations				Major Roads	Major Railways	Major Airports
	Road	Rail	Aircraft	Industry			
1 (2007)	78%	72%	66%	89%	96%[50]	95%[51]	97%
2 (2012)	78%	75%	52%	69%	79%[52]	73%[53]	75%

Source: END_DF4_Results_2007 sheet for R1; END_DF4_DF8_Results 2012 sheet for R2 provided by European Topic Centre on Air Pollution and Climate Change Mitigation. Data last updated in June 2015.

[48] EEA Report. Noise in Europe 2014. P. 13, June 2014
[49] Source: END_DF4_DF8_Results
[50] 26 out of 27 countries – Greece did not provide data
[51] 19 out of 20 countries – Greece did not provide data, 8 countries did not have any major railways in 2005.
[52] 22 out of 28 countries
[53] 19 out of 26 countries – 2 countries did not have any major railways in 2010.

The table indicates that **there have been significant delays in noise mapping in both Rounds**. For instance, in R2, at the cut-off date for the analysis, reporting data was at best complete for 79% of Member States for major roads.

Although the data in R1 is almost complete for major roads, it is difficult to compare this to R2 completeness since an additional five years have passed since the R1 SNMs were supposed to be submitted.

In R2, there are still major gaps in the completeness of data on SNMs and population exposure data from road, rail and aircraft sources inside agglomerations. However, as explained further below, the 79% reporting submission completion estimate refers to the number of Member States that have submitted data, rather than to the proportion of major roads mapped. The data does not necessarily cover all major roads segments within these Member States.

Within agglomerations, the table shows the percentage completeness separately for each of the three different modes of transport plus noise from industry. This is due to the fact that CAs are required to report information on population exposure through SNMs for agglomerations separately for each source of noise, as mentioned above. Data on aggregate noise exposure to all sources within agglomerations is not collected systematically by MS since this is voluntary information.

The percentages provided describe the number of agglomerations out of the total reported by MS CAs to the EC two years before the due submission date for which a complete dataset as to the number of exposed people must be reported. The figures cover all road/railway/aircraft including the data to be reported for *major sources* and industry exposure. For example, the 78% for roads inside agglomerations (both Rounds) means that 78% of agglomerations that were expected to report data on exposure to road noise, including noise from major roads, did in fact report this data by 30th of June 2015.

Completeness has improved considerably compared to the data presented in the Noise in Europe report: i.e. in the period between August 2013 (the original cut-off date for analysing completeness data included in the Noise in Europe report) and June 2015, when an additional data cut-off analysis of SNM data was run. For instance, the completeness of SNMs and population exposure data for agglomerations for road noise increased from 62% to 78%, and for rail noise up from 57% to 75%, for aircraft from 44% to 52% and for industrial noise from 56% to 69% (percentage values referring to R2).

The percentages for SNMs for major roads and major railways correspond to the number of Member States out of the EU-28 (EU27 for R1 since Croatia acceded in 2013) who have submitted data rather than the number of road or rail segments for which information has been provided. Completeness of the road and railway network infrastructure as such (measured in road and rail segments to be mapped) cannot be calculated due to how the information is provided at the moment.

Consequently, the percentages given for major roads and major railways do not necessarily imply that these MS have submitted complete data covering the *total length* of km within END scope. This means that the percentages may present completeness in a more favourable way than if the data was based on road and rail segments measured in km. It should furthermore be noted that it is not entirely clear whether data submitted by MS on major roads and major railways refers only to those railway and road segments located *within* or *outside* agglomerations, or *both*. The contractor supporting the EEA states that MS (and regions within MS) define agglomerations and major infrastructures differently, and have chosen different interpretations and a different scope for the reporting mechanism. For further information on the implications for the reporting mechanism, please refer to EQ12 in Section 3.

The data for airports refers to the number of airports out of the total within END scope for which data has been reported to the EC in each Round. This refers to the number of major airports rather than the number of agglomerations affected by aircraft noise.

Overall, **the level of reporting data and information completeness in R2 is below the corresponding level of completeness in R1 even three years after the required submission date for R2 SNMs.** This is the case for all SNMs except for those for road and railway noise inside agglomerations where data is more complete in R2 than in R1. However, as mentioned in the previous paragraph, the data does have some limitations and for this reason, the completeness of road and railways' network cannot be evaluated as such, and only values at country level can be presented. This issue and its implications for the efficiency of the reporting mechanism are further discussed in section 3.2.4. Moreover, the finding that completeness in R2 is below completeness for R1 needs to be viewed in the context of the increased amount of mapping necessary given, the move to definitive thresholds (see section 2.2.3).

The data above present the picture at EU-28 aggregate level.

During the interview programme, EU MS put forward a number of possible explanatory factors for the delays in noise mapping in R2. In **Germany,** for instance, delays were attributed to a lack of knowledge among responsible CAs at local level about input data acquisition needed for strategic noise mapping purposes. A further issue was the need for coordination in noise mapping for administrative areas within agglomerations that border one another. This was a considerable problem due to the strong element of decentralisation in respect of noise mapping under the German national implementing rules.

Examples of implementation challenges relating to noise mapping that may have contributed to the aforementioned delays are outlined below. These are ranked according to the frequency that they were mentioned by Member States.

- **A lack of sufficient human and financial resources** to meet noise mapping commitments in full and / or the lack of in allocating these resources sufficiently promptly made it difficult to meet R2 SNM reporting deadlines (**15 MS – AT, BE, BG, CZ, ES, HR, FI, IT, LV, LT, PL, RO, SE[54], SK and the UK**);
- **Budgetary difficulties due to the economic and financial crisis were explicitly mentioned in some EU Member States as having led to delays in noise mapping being undertaken.** In PT and ES, there were significant cuts in public and private budgets, especially after 2011, in the context of the financial bailout that took place in PT. Although in ES, there was no bailout, there was a financial assistance package at national level, which imposed very tight conditions on budgets. This was one of the major reason for delays in R2 noise mapping.
- **Additional resources were needed** in order to meet the full implementation scope of the END once the definitive thresholds came into effect in R2 **(5 MS– IE, LU, PT, RO and SK)**;
- **Lack of centralised, complete and consistent traffic, spatial input and noise emissions data** – often, estimates were used when actual data was unavailable (e.g. in FR for road data, **7 MS– BE, BG, CZ, FR, HR, IT and RO**);
- **Lack of effective coordination among CAs** responsible for the END in the collection, management and administration of input data for noise maps (**6 MS – AT, CY, DE, FR, NL and PT**);
- **Lack of data comparability –** there are a number of different reasons why it has proved difficult to achieve full data comparability between Rounds across all sources

[54] Only in some agglomerations

and EU MS, such as differences between rounds in the sources of input data, the methodology and computation method applied, changes in the modelling software used, etc. Comparability issues were mentioned in **DK, NL, SK and the UK,** among others). The issue of comparability was found to affect different sources to varying degrees of magnitude. For instance, airports tend to be more comparable between Rounds, since the thresholds have not changed (although there may still be differences, e.g. in input data, methodologies, software to estimate noise exposure).

- **Lack of data comparability between different EU MS –** different approaches to noise mapping have been adopted in different MS. Some MS currently use the interim methods presented in Annex II of the END, whereas other continue to use national methods. Data comparability will remain limited until based on the CNOSSOS-EU methodology, has been implemented.
- There are differences in approaches between EU MS with regard to the mapping of major roads. For instance, in **DE**[55]**,** in R1, outside of agglomerations, the network of "major roads" was defined as being required only for federal and regional roads with more than 3 million movements. Whilst the formal requirements of the Directive were met, corresponding to the R1 thresholds, in the view of some stakeholders, this meant that mapping of road noise outside agglomerations was "incomplete" for the purposes of informing noise action planning.
- Lack of a suitable database to allow input data to be easily updated in subsequent rounds rather than to start afresh **(CY)**.
- Another issue relates to the fact that noise levels in agglomerations may be affected by noise from sources in another, adjacent administrative region (the same applies to national borders where agglomerations are located near them). In these cases, data on the noise from sources across the administrative border has to be requested from other administrative authorities. At times, such data was not readily available at the time when noise maps were being developed (**BE, DE, HU, RO**).
- One of the reasons for the delay in noise mapping in Romania was the need to wait for the results of the 2011 Population Census to become available **(RO)**. This was also cited as one of the reasons for delays (among others) in **CZ** and in **MT.**
- In **DE,** some delays were encountered. These were attributed to over-fragmentation of responsibilities within agglomeration for procuring noise mapping services. There also appeared to be a lack of knowledge among responsible CAs at local level about the need for timely and consistent input data acquisition needed for noise mapping.
- A further issue identified in **DE** was the need for coordination in noise mapping for administrative areas within agglomerations that border one another. This was a considerable problem due to the strong element of decentralisation in respect of noise mapping under the German national implementing rules.

Delays in the preparation and submission for reporting purposes of SNMs in R2

A number of reasons were put forward by stakeholders interviewed and participants taking part in the workshop as to the possible reasons for the delays experienced in the submission of R2 SNMs in some EU countries.

- At local level, noise mapping was sometimes viewed as an administrative burden passed on from the EC to national CAs (and in turn on to local authorities).
- As a consequence, delays were experienced in the preparation of SNMs wherever local authorities either lacked the budget to undertake noise mapping at the local level (e.g. at the commune level in FR) or did not see the value added in producing

[55] Umsetzung der Richtlinie 2002/49/EG über die Bewertung und Bekämpfung von Umgebungslärm in Deutschland. P. 3

maps (e.g. smaller municipalities in **DK, FR and NL**), since they did not appreciate the direct link with informing policy development.

- Several stakeholders (e.g. interviewees in **ES, FR and NL**) stated that noise mapping had been delayed in R2 because local authorities did not assign it as a high priority (and in some instances, refused to produce the required SNMs).
- A stakeholder from Germany taking part in the workshop suggested that delays in R2 may be explained by the shift in resources devoted from noise to other environmental issues such as climate change and air pollution (which are often covered by the same budget lines).

Several issues relating to SNMs were also highlighted by respondents to the online survey. Whilst it was acknowledged by more than 50% of respondents that problems in R1, such as difficulties in data collection and in the quality of input data, had largely been resolved by R2, other issues remain, such as a lack of interest in the results of noise mapping among citizens and local levels of administration. Not all stakeholders agreed that the main problems identified in R1 have now been resolved however, since challenges in relation to the lack of quality input data remain in a number of EU countries.

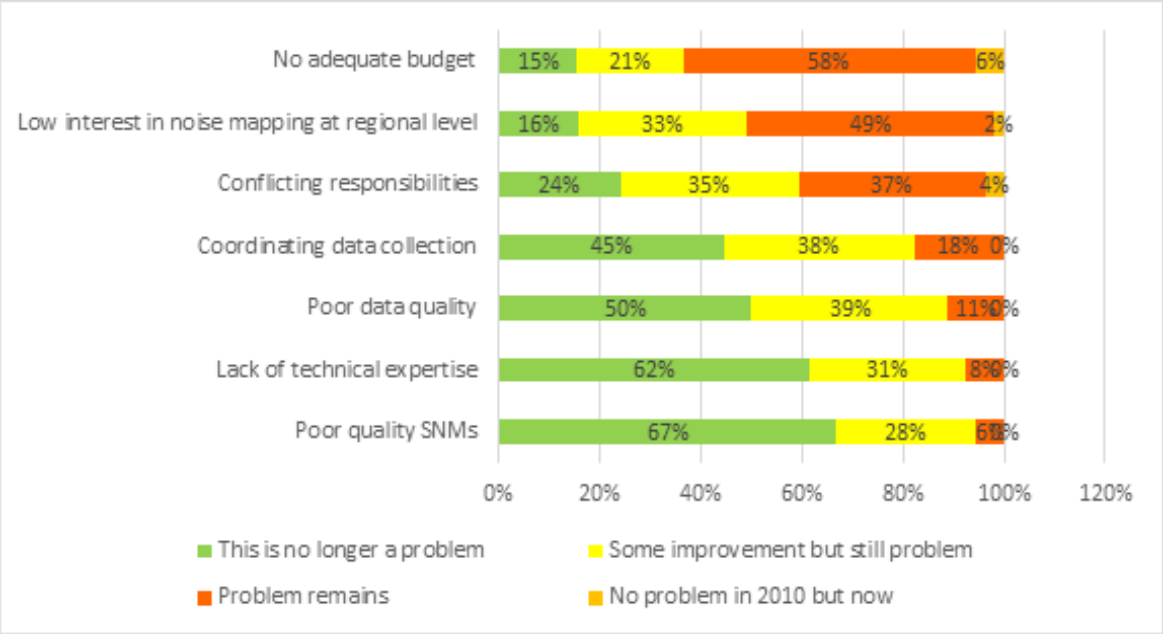
Art. 1(1b) of the Directive requires MS to **"ensure that information on environmental noise and its effects is made available to the public".** Through the second implementation review, the extent to which such information is being made available was assessed through the country reports.

The provision of SNMs online is the predominant means of providing noise maps and information on population exposure in a clear, comprehensible and accessible manner. A number of stakeholders confirmed that there were challenges in ensuring that noise maps were correctly interpreted by those using them. Some noise mapping bodies have therefore published a list of FAQs to ensure that noise maps by source are not misinterpreted (see case study in Appendix I on the publication of FAQs in Ireland).

Some general findings based on the analysis of the online survey regarding challenges affecting both strategic noise mapping and noise action planning are presented at the end of the next sub-section.

The figure on the following page summarises the feedback received from public authorities responding to the online survey on **key implementation issues related to noise mapping**.

Figure 2.5 - When surveyed as part of the first legal implementation review in 2010, those involved in implementing the Directive highlighted various issues in respect of noise mapping. Please indicate whether the issues identified still apply to your organisation? (n=56)



Source: Online survey of public authorities

As the above Figure shows, some END implementation issues related to noise mapping have been at least partially successfully addressed between R1 and R2. For instance, issues such as the poor data quality of input data and the lack of technical expertise seem to have been broadly resolved by R2. Good progress was found to have been made between Rounds in respect of core END implementation activities by national CAs, such as coordinating the process of data collection on SNMs, where 41% of respondents believed that this issue were no longer a problem. However, the position appears to be more nuanced across the EU-28 as a whole. For instance, 38% of respondents believed that although there had been some improvements between rounds, there were still difficulties in coordinating data collection.

With regard to the issue of poor data quality, there was a difference between the findings from the online survey and the findings from the research presented in the country reports which also took into account interviews with CAs. These suggested that there remains a problem with the quality of input data in 11 MS in R2. The country reports are judged as being more accurate, since these are based primarily on interviews with national CAs who ought to be in a position to judge, given their overarching coordination role.

Among those aspects of END implementation relevant for noise mapping where there does not appear to have been progress and problems remain are the low level of interest in some MS at local and regional levels in the END, as well as a lack of adequate budget, which was seen as a problem remaining for 58% of respondents.

Strategic noise mapping and the cross-border dimension

Belgium's geographic situation in close proximity to several other EU MS (FR, NL, LU, DE) necessitated co-operation with neighbouring regions, and intra-regional alignment to ensure that cross-border regions were covered through noise mapping.

In **Germany,** there was a lack of political willingness at regional level and among local authorities at municipality level to classify which areas crossed national borders as agglomerations and the associated challenges of delimiting such agglomerations.

In **Austria**, the difficulty of noise mapping in border areas was highlighted in R1, since noise levels in agglomerations can be affected by noise from sources in another, adjacent administrative region (the same applies to national borders where agglomerations are located in proximity). Data on noise sources across the administrative border has had to be requested from other administrative authorities. Such data was not readily available at the time when noise maps were developed. This problem has persisted in R2, since no remedial action was taken.

Strategic noise mapping and industrial noise within agglomerations

Lastly, given that strategic noise mapping also covers industry as a source of noise within agglomerations, it is worth examining some of the implementation issues with regard to **noise mapping and industry.**

In **Latvia,** the main problem identified was a lack of suitable input data for industrial sources. There has been an effort to improve the availability and quality of input data between R1 and R2. In particular, changes were made to requirements for industrial objects for IPPC permit applications. However, this hasn't been effective so far in improving data quality.

Further feedback with regard to issues relating to the END and industrial noise are addressed in the evaluation part of the report since these are less relevant to the implementation review (see Section 3.2.2 EQ3 specific legal gaps, overlaps and inconsistencies).

2.3.8 Noise Action Planning

Introduction

According to Art. 8 of the END, MS CAs are required to draw up Noise Action Plans ("NAPs") based on noise mapping results. NAPs must contain measures addressing noise issues and their effects for major roads, major railways, airports and agglomerations. The action plans must meet the minimum requirements laid down in Annex V of the END, relating, *inter alia,* to designation of CAs, noise-reduction measures already in place and projects in preparation, actions to be taken in the following 5 years, long-term strategies and financial information. Also under Art. 8, the END also requires that the public shall have the opportunity to comment on proposals for action plans and the possibility to participate in the elaboration and reviewing of the action plans.

This sub-section considers, in summary:

- The completeness of information on Noise Action Plans ('NAPs');
- Noise mitigation, abatement and reduction measures identified in NAPs;
- Availability of guidance on the preparation of Noise Action Plans
- Issues relating to the main challenges in action planning and in the implementation of NAPs; and
- Variations between EU MS as to whether (expenditure) measures identified in NAPs have actually been implemented.

The completeness of information on Noise Action Plans

Since there was a significant increase in the number of SNMs between R1 and R2 due to the transition to the definitive END threshold, it can be reasonably assumed that there has also been a major increase in the number of NAPs falling within the scope of the END. This has been confirmed through the EIONET data on NAPs and through the research to develop country reports.

Data on the **completeness of information** reported on NAPs has been obtained from the EIONET reporting system. The table below provides an overview of the situation on the completeness of NAP information submitted to the EC across the 28 EU Member States in R2 as at the most recent cut-off point (end November 2015).

Table 2.8 - Completeness of data submitted to the EC by 28 EU MS in R2.

Member State	Completeness			
	Agglomerations: submitted/no. of agglomerations within END scope (%)	Roads (in % of action plans submitted out of total number of road segments within scope)	Railways (in % of action plans submitted out of total number of rail segments within scope)	Airports (submitted/no. of airports within END scope)
AT	5/5 (100%)	100	100	1/1 (100%)
BE	6/6 (100%)	0	0	1/1 (100%)
BG	4/7 (57%)	100	n/a	n/a
CY	0/2 (0%)	0	n/a	n/a
CZ	0/7 (0%)	0	0	0/1 (0%)
DE	21/71 (30%)	Analysis not possible	Analysis not possible	2/9 (22%)
DK	4/4 (100%)	100	100	3/3 (100%)
EE	2/2 (100%)	100	0	0/1 (0%)
FI	8/8 (100%)	6	100	1/1 (100%)
FR	Analysis not possible	Analysis not possible	Analysis not possible	4/9 (44%)
EL	Analysis not possible	Analysis not possible	Analysis not possible	Analysis not possible
ES	2/64 (3%)	4	0	0/13 (0%)
HR	0/4 (0%)	13	0	n/a
HU	8/9 (89%)	0	0	0/9 (0%)
IE	2/2 (100%)	100	100	1/1 (100%)
IT	3/29 (10%)	0	99	0/10 (0%)
LV	1/1 (100%)	100	0	1/1 (100%)
LT	5/5 (100%)	100	100	n/a
LU	0/1 (0%)	0	0	0/1 (0%)
MT	0/1 (0%)	100	n/a	n/a
NL	17/21[56] (81%)	10/12 provinces	100	1/1 (100%)
PL	22/39 (56%)	0.4	0	0/1 (0%)
PT	1/6 (17%)	0.7	0	2/2 (100%)

[56] In case of the Netherlands, the 21 agglomerations were further broken down into 96 municipalities for which 85 NAPs have been submitted to date.

Member	Completeness			
RO	2/19 (11%)	0	6	1/1 (100%)
SI	0/2 (0%)	0	0	n/a
SK	0/2 (0%)	30	0	n/a
SE	11/13 (85%)	100	100	3/3 (100%)
UK	73/73 (100%)	100	100	15/15 (100%
Total	197/403 (49%)	47 (average)	41 (average)	36/84 (43%)

Source: November 2015 data provided by DG Environment based on data in the EIONET reporting system.

For agglomerations and airports, data is also available on the completeness in R1, allowing for a comparison: Whereas 75% of R1 agglomeration NAPs have been submitted, this is the case for only 54% of R2 agglomeration NAPs. For airports, submission is similarly incomplete for both Rounds (only 46% have been submitted).

Since there were more frequent delays in the submission of SNMs to the EC in R2 compared with R1, particularly within agglomerations and for airports (both within and outside agglomerations), there have been knock-on effects in the timeframe for the drawing up, adoption and submission of *NAPs* to the Commission. The data above present the picture at EU-28 aggregate level. For more detailed contextual information, the country reports provide a bottom-up estimate as to the numbers of NAPs that each MS has submitted (or in instances where the NAP has been submitted late, the data relates to the number of NAPs that are due to be submitted to the EC).

Delays in R2 reporting submissions and possible explanatory factors

The previous table shows that less than half the agglomerations for which NAPs were meant to be submitted by July 18th 2013 for R2 had indeed submitted NAPs by November 2015 for (197 out of 403 or 49%) while on average, 47% of NAPs for major road segments and 41% of NAPs for major railways segments had been submitted by that date. Moreover, NAPs had been submitted for only 36 out of 84 (or 43%) airports. The table also shows that by November 2015, only 5 out of 28 Member States (**AT, DK, FI, IE and the UK)** had submitted all NAPs that were due in R2. In the remaining 23 Member States, some NAPs for at least one transport mode or for agglomerations were still missing.

An analysis of the information by transport mode shows that as of November 2015:

- NAPs for agglomerations were complete in 8 MS (AT, BE, DK, EE, FI, LV, LT, UK),
- NAPs for major roads were complete in 10 MS (AT, BG, DK, EE, IE, LV, LT, MT, SE, UK),
- NAPs for major railways were complete in 8 MS (AT, DK, FI, IE, LT, NL, SE, UK), and
- NAPs for airports were complete in 11 MS (AT, BE, DK, FI, IE, LV, NL, PT, RO, SE, UK).

A number of explanatory factors were put forward to explain the delays in the submission of NAPs:

- Delays in the preparation of SNMs in some EU MS (see previous sub-section) have led to knock-on delays in the drawing up, adoption and submission of NAPs (since these have to be prepared based on noise mapping results).
- The period of 12 months between the submission of SNMs and NAPs was considered as too short and unrealistic in the majority of EU MS **(15 MS– AT, BE, CZ, FI, EL, FR, HU, LV, NL, PL, PT, RO, SE, SK, UK).**
- In particular, stakeholders stated that there is a need to allow sufficient time for meaningful consultation to take place, for NAPs to be prepared and to ensure public acceptance. Whereas in R1, delays were mainly related to the need for familiarisation but benefitted from the fact that there was less volume of mapping and action planning work under the transitional thresholds, the increase in workload due to the definitive thresholds being applied appears to have been partly responsible for the delays in R2.
- The implementation approach itself, particularly when a decentralised approach has been adopted that requires coordination among many different actors at different levels of governance.
- Whilst in some countries, the implementation approach worked reasonably well in R1, when only the transitional thresholds applied, but once the definitive thresholds were applied, there were problems in coping with the volume of work implied by the significant increase in the amount of NAPs that had to be produced in R2.

Feedback was received on this issue through the interviews, with further feedback from participants in the validation workshop:

- **FR –** the delays were attributed primarily to the strongly decentralised way in which the END has been implemented for agglomerations. The interpretation of an 'agglomeration' as relating to the *commune* level means that large numbers of NAPs need to be produced for agglomerations. In smaller communes, there were difficulties in persuading the local *mairie* to carry out noise mapping and action planning due to lack of budget and expertise.
- **DE –** there were delays in the completion of SNMs (explained in the earlier sub-section on NAPs), which led to knock-on delays in the finalisation of NAPs. There was also a problem that the methods selected for ensuring adequate public participation in action planning was insufficient given the expected 12 months' timeframe between when MS are required to submit SNMs and NAPs. Significant delays were also reported in DE due to the fact that political bodies must approve the noise action plans for municipalities. A further issue was that responsibility for preparing NAPs lies with different CAs from those involved at local level in undertaking mapping, which requires additional coordination time.
- **IT –** there was a particular problem with the non-submission of NAPs for agglomerations and airports. This was attributed to the decentralised approach, which required a complex coordination of multiple actors along the process, from the definition of SNMs to the development of NAPs. In R1, the national CA failed in providing effective guidance to the designated CAs on how to gather and elaborate data to develop SNMs and NAPs. Municipalities and provinces were particularly affected, especially when definitive thresholds were applied in R2. There were problems in coping with the volume of work implied by the significant increase in the amount of NAPs that had to be produced in R2. This was particularly challenging for local authorities dealing with agglomerations due to lack of resources and technical knowledge.
- **LU** - there have been delays in the development of draft NAPs and significant delays in the adoption of final versions of NAPs and in making these publicly accessible. The NAPs require political approval before they can be finalised, even if the drafts

have been submitted to the EC. The delays were attributed in part to the need to allow sufficient time for public consultation and to enable feedback received through consultations to be taken into account and reflected in revised NAPs.

- **NL -** the 12-month timeframe does not pose a problem in instances when the corresponding SNMs and levels of population exposure have not changed much between Rounds – meaning that authorities can already start action planning processes before SNMs are completely updated.
- **SE -** political decision making leading to the final adoption of NAPs following the initial completion of SNMs already takes up to 6 months, i.e. half the total time allocated to the period between the submission of SNMs and NAPs. However, it was suggested that this could be remedied by starting the political decision-making process before SNMs are finalised.

Noise mitigation, abatement and reduction measures identified in Noise Action Plans

An analysis was carried out of the **different types of measures supported in NAPs** in each round to ascertain whether there was continuity between Rounds. A key finding was that in R2, the types of measures identified are broadly similar to those supported through R1 NAPs. There are many examples of measures mentioned in NAPs in both R1 and R2. This includes those that continue to be implemented over a period that extends between Rounds. The most frequently mentioned measures in NAPs analysed in the 28 MS reports are: technical measures at source, noise insulation, land-use planning, traffic planning, quieter road surfaces and the installation of noise barriers.

In the following table, MS are clustered according to the types of measures that were most commonly identified in NAPs.

Table 2.9– Clustering of EU Member States by measure type

List of common noise reduction and mitigation measures	Clustering of Member States by most commonly used measure types
Technical measures at noise source	19 MS – AT, BE, BG, CZ, DE, EE, EL, ES, FR, HR, HU, IT, LT, LV, LU, PL, RO, SE, SK, UK
Noise insulation	18 MS – AT, BE, BG, CY, CZ, DE, DK, EE, EL, ES, FR, HU, IT, LT, LU, NL, PL, PT, RO, SE, SK
Land-use planning	19 MS – AT, BE, BG, CZ, DK, EE, ES, FI, FR, HR, HU, IE, IT, LT, LV. PL, RO, SI, SK, UK
Traffic planning (incl. speed reductions)	14 MS – AT, BE, CY, DK, EE, FR, IE, IT, LT, LV, NL, PL, PT, RO, UK
Quieter road surfaces	10 MS – AT, BE, DE, EE, EL, IE, IT, NL, PL, RO, UK
Installation of noise barriers	12 MS – BE, CY, DK, EE, EL, FI, IE, LT, LU, PL, PT, SE, SK
Selection of quieter sources (incl. promotion of quieter public transport)	5 MS – BE, CY, CZ, LT, LV
Other (e.g. measures to reduce sound transmissions in buildings, incentives and capacity-building)	6 MS – BE, ES, MT, LT, LV, SK.

Source: own assessment of measures based on 28 country reports.

The table above indicates that there is considerable diversity as to the types of measures identified by Member States in NAPs. The most common measures have been adopted by more than half of all Member States. Measures vary greatly in terms of their scope and the level of expenditure required to implement them.

The criteria mentioned by CAs for determining the selection of noise mitigation, abatement and reduction measures included cost-effectiveness (although a proper assessment was in many MS undermined by a lack of data), compatibility with existing legislation, flexibility in application, number of beneficiaries and how easy measures could be implemented. More information on the typical cost benchmarks for measures is provided in Section 3.2.4, which draws on 19 case studies that were carried out to assess the costs and benefits of measures to tackle noise at receptor.

Availability of guidance on the preparation of Noise Action Plans

In R1, several MS developed **national guidance** on Noise Action Planning. Those MS with legally binding noise limit values and guidelines had generally used exceedance as the basis for prioritising measures contained in NAPs. MS that specified that they used health-based assessments in the establishment of priorities include **Cyprus, Finland, Romania** and **Belgium (Wallonie).** The use of population exposure as a criterion to establish priorities was also common. A similar profile was seen in R2, although NAPs were still being developed and/or subject to approval in Q2 2015 in Bulgaria, Greece, Malta and Wallonia (Belgium).

However, despite the availability of national guidance, some stakeholders interviewed perceived there to be a lack of guidance at EU level on the drawing up of Noise Action Plans, and in particular on cost-benefit analysis.

Whereas guidance has been produced at EU level to assist CAs in carrying out strategic noise mapping[57], this does not appear to be the case in respect of noise action planning. In 2010, the EEA developed a *Good practice guide on noise exposure and potential health effects*[58]*.* This provides some guidance on how to measure costs and benefits but with a focus on measuring the health effects. It sets out exposure-response relationships and thresholds for health endpoints and provides background information about concepts relevant to measuring health effects, such as the use of DALYs and hedonic pricing techniques.

The EC discussed with MS the future revision of Annex III of the END, which would provide guidance on assessing the health effects of noise, and the appropriate dose response relationships to be applied by source. This will be based on the revised WHO guidance on dose response relationships that is expected to be published in the end of 2016.

However, many END stakeholders maintained that more practical guidance is also needed as to how the costs and benefits of individual measures can be assessed as part of the 'financial information' section when preparing their NAP.

The evaluators note that the work carried out through the CBA and the development of quantitative case studies as part of this study could provide the basis for updating EU guidance in future. For instance, cost and benefit benchmarks are provided for the order of magnitude of costs/ benefits for different types of measures.

[57] Good Practice Guide for Strategic Noise Mapping and the Production of Associated Data on Noise Exposure, 2007, WG-AEN

[58] EEA Technical report No 11/2010

The research identified a number of examples of countries (e.g. **DE, IE, LT and the UK – England, Wales, Northern Ireland and Scotland have produced separate guidance**) that have developed non-binding guidance at national level on the preparation of NAPs. Examples of the wide range of guidance available are provided in the following:

Box 2.2 National guidance on noise action planning (selected examples)

In **Germany,** national guidelines for noise action planning have been developed, the "Hinweise zur Lärmkartierung", by the Bund-Lander working group on emissions protection, although these are non-binding recommendations. A number of individual cities and / or Länder, such as Brandenburg, Hamburg, Hesse, North-Rhine Westfalia, Saarland and Schleswig-Holstein have developed complementary guidelines.

Ireland produced a Guidance Note for Noise Action Planning[59] for the first round of the Environmental Noise Regulations 2006. In the UK (**England),** Defra prepared Guidance for Airport Operators to produce noise action plans under the terms of the Environmental Noise (England) Regulations 2006 (as amended) July 2013. For other transport sources, Defra provides a Noise Action Plan Support Tool to help relevant authorities with the action planning process. In **Portugal,** guidance[60] has been provided for the development of noise reduction plans by municipalities.

Guidance at the national level has also been developed in many but not all of the new member states. For example, in **Hungary,** guidelines have been produced on action planning at national level[61]. In **Slovakia,** a guidance document "Expert Guideline No. OZPaZ/ 5828/2007" was produced by the Public Health Authority of the Slovak Republic. The aim was to define the principles of action plan preparation and the rules and procedures for information to the public, in accordance with Act. No. 2/2005 Coll.[62] and the END. In **Lithuania,** national guidance has been developed to provide methodological assistance and to harmonise the preparation of noise action plans through a common noise action planning methodology (the Exemplary Model for the Organization and Implementation of Environmental Noise Prevention)[63].

In **Latvia,** guidelines were established at national level for drawing up and implementing noise action plans (NAPs)[64]. In **Estonia,** national guidelines for drawing up action plans are available online.[65]

Among EU13 (new) member states that have not developed formal guidance are **Romania** (where nevertheless there is some internal guidance on what has to be reported to the environmental authority in terms of common data to be provided in each NAP).

Although many MS have developed national guidance, the interview feedback found that national CAs would like the EC to provide EU level guidance on action planning so as to help strengthen and update existing national guidance. This was especially the case in those MS that joined the EU more recently.

[59] epa.ie/pubs/advice/noisemapping/EPA%20Guidance%20Note%20for%20Noise%20Action%20Planning.pdf

[60] www.apambiente.pt/_zdata/DAR/Ruido/NotasTecnicas_EstudosReferencia/PMRR.pdf

[61] http://www.kvvm.hu/cimg/documents/_12___tmutat__zaj.doc

[62] http://www.health.gov.sk/redsys/rsi.nsf/0/3e6b545e2697a78cc1256f970033e1b0/$FILE/vestnik0707.pdf.

[63] An exemplar of a NAP is published on the website of the National Public Health Surveillance Laboratory under the Ministry of Health at http://nvspl.lt

[64] www.health.gov.sk/redsys/rsi.nsf/0/3e6b545e2697a78cc1256f970033e1b0/$FILE/vestnik0707.pdf

[65] http://www.riigiteataja.ee/ert/act.jsp?id=13164685 and http://www.riigiteataja.ee/ert/act.jsp?id=917329

Variations as to whether measures identified in NAPs have actually been implemented

There are wide differences between EU MS as to whether measures identified in NAPs are actually implemented. Formally speaking, the END only requires a NAP to be drawn up. Art. 8(1) states that MS shall draw up action plans designed to manage, within their territories, noise issues and effects, **including noise reduction if necessary.** There is however no explicit requirement for measures to be implemented. Art. 8 notes that *"the measures within plans are at the discretion of competent authorities, but should address priorities which may be identified by the* **exceeding of any relevant limit value** *or by other criteria chosen by the Member States and apply in particular to the most important areas as established by strategic noise mapping".*

It is of course implicit that Member States should not only identify, but actually implement suitable measures. Although the regulatory approach **fully reflects subsidiarity,** the research found that different MS have interpreted the lack of a formal requirement to implement measures differently. For instance, some MS have supported measures that require expenditure, whereas others have mainly identified non-spending measures. A further issue is that due to the **global economic and financial crisis** and associated **cuts in public budgets, some MS may have** identified spending measures in NAPs, but they have not been in a position to identify budget to actually implement these measures.

It is consequently difficult to obtain a comprehensive picture across the EU as to which measures have been fully implemented, those that have been partially implemented and those that have not gone ahead at all. Whilst Annex V of the END setting out the minimum requirements does stipulate that NAPs should contain information about what measures have gone ahead previously, there is in practice often a lack of clear information on which measures were implemented in the previous round.

Selected examples from different MS of the situation in respect of the implementation of measures in NAPs and associated challenges are now provided.

In the **Netherlands,** considerable budget was set aside for measures identified in NAPs in both R1 and R2, with evidence of an increase in funding for noise mitigation, abatement and reduction compared with the situation before the END was introduced. However, a particular problem was identified that even in cities that had expended significant resources, such as Rotterdam which invested significantly in quieter road surfaces, the situation had actually worsened in terms of the number of persons exposed. This was due to a lack of comparability of noise maps across Rounds – the different noise modelling tools used in R2 resulted in a higher figure for the number of people exposed. While the investment should in theory have reduced the number of people sleep disturbed or highly annoyed, the lack of data comparability made it difficult to quantify the impact. This in turn made it more difficult to persuade politicians of the need for further spending measures in R2, given the question mark as to the cost-effectiveness of measures already implemented.

The lack of resources due to the financial crisis was identified as a problem in a number of MS. This has meant that to date, in several EU MS, the measures that have been implemented have mainly been non-expenditure measures, such as promoting increased use of public transport, encouraging more walking and cycling etc. In **Italy,** for instance, the lack of resources due to the financial crisis was a major problem, according to interviewees from both the national and regional authorities. However, some expenditure measures were implemented, such as laying quieter asphalt, although it was difficult for the responsible authorities to specify the extent of attribution to the END, as opposed to Italian national legislation on noise.

In **Ireland,** whilst a number of spending measures were identified in the NAP for Dublin City agglomeration in R1, due to the crisis, only non-spending measures were actually implemented, such as encouraging more sustainable forms of transport use (walking and cycling, travelling more often by public transport rather than by car, etc.). In **Latvia** and **Lithuania**, it was also acknowledged by the respective national CAs that the crisis had led to a scaling back of the level of ambition at the measure level during implementation compared with the original intention when the R1 NAPs were produced.

A further problem identified in both R1 and R2 was that in many EU MS, there was a lack of dedicated budget for environmental noise. Achieving progress in tackling noise at receptor therefore remained strongly dependent on whether funding could be earmarked from other policy areas such as transport, urban development and planning, infrastructure development etc. A number of interviewees recognised that one of the challenges for CAs responsible for implementing NAPs is that environmental noise mitigation and reduction is not the primary driver of many measures, but rather an important secondary benefit.

There are however some types of measures identified in NAPs where environmental noise reduction is the primary driver, such as noise barriers (to tackle road traffic and sometimes railway noise) and noise insulation of windows (aircraft noise). Examples are provided in the table below to illustrate this point:

Table 2.10 - Examples of measures identified in NAPs and extent to which noise mitigation a primary or secondary driver

Policy area	Policy objective (primary)	Measure type	Environmental noise – driver type (primary, secondary)
Transport	• Reduce road traffic noise	• Noise barriers	Primary
Transport	• Reduce aircraft noise at receptor	• Noise insulation measures	Primary
Transport Urban planning	• Road safety • Improving air quality	• Traffic calming measures • Speed reductions	Secondary
Transport/ infrastructure development and planning	• Infrastructure improvement • Economic development	• Pre-planned road infrastructure programmes • Laying quieter asphalt	Often secondary, but sometimes primary

Source: bottom-up feedback collected from the Member States, as presented in the 28 country reports

In some instances, measures that were identified in NAPs have gone ahead, but it was difficult to attribute these solely to the END, either because the measures originated from national legislation that preceded the END or the measures were already planned prior to the END being adopted (reflecting the long-term nature of many transport and infrastructure-related measures that have benefits from an environmental noise abatement, mitigation and reduction perspective).

It is also important to observe that there are differences between MS in action planning approaches that are reflected in the way in which **measures are identified.** Whereas in some MS (e.g. DE)**,** a long-list of measures is provided in NAPs, and only some of these measures have a realistic chance of being implemented, in other MS for instance, in southern Europe and in many of the new MS, measures are only included if expenditure has actually been identified and set aside for costed measures. In **France**, the national CA referred to a concern among many local authorities involved in action

planning in agglomerations that measures should not be mentioned in NAPs unless there was a realistic chance of them going ahead. Otherwise, this risked raising false expectations among citizens at local level.

In **Germany,** for instance, among the research findings from a review of a sample of NAPs was that many measures identified in R1 NAPs were already planned prior to the END coming into effect and have simply been continued. Interviewees mentioned that this was due to the fact that Germany had strong environmental noise legislation prior to the END coming into effect. However, if the END is seen as an umbrella for bringing together different types of measures that help to mitigate and reduce environmental noise at receiver, then evidence of considerable expenditure can be found, for instance, through measures such as laying noise-reducing asphalt and noise insulation of windows.

In assessing how far progress has been made through the implementation of measures identified in NAPs to tackling noise at receptor, the baseline situation should also be taken into account. For instance, although **Ireland** has mainly implemented non-expenditure measures, during the economic boom of the 1990s, an interviewee stressed that significant investment had been made in the development of a new motorway network, which meant that there were much quieter road surfaces compared with many other Member States.

Other issues relating to the implementation of Noise Action Plans

A number of implementation challenges were identified in the first implementation report relating to action planning in 2011. Whilst some issues have been resolved, for instance, there is greater access to technical expertise to assist in supporting action planning in R2 than in R1, there remain a number of outstanding implementation issues in R2.

A summary of the main issues related to the implementation of NAPs raised through the online survey and interview programme is now provided (it should be noted that issues relating to the delays encountered in R2 were analysed earlier). Where appropriate, participant feedback from the workshop is also highlighted:

- Lack of adequate participation in public consultations on draft NAPs (**5 MS– DK, EE, HU, NL, UK**);
- Lack of enforcement mechanisms to ensure that measures to promote noise reduction are effective, such as sanctions in the case of exceedence (**5 MS- BG, DE, DK, LT, RO**);
- Lack of experience and appropriately qualified local noise experts **(EL, LV, PL, RO);**
- Lack of know-how as to how to assess the costs and benefits of individual measures within NAPs and at the level of the action plan overall (almost all EU MS).
- Lack of assessment of the economic impacts of proposed measures in NAPs adopted (**CZ);**
- Examples of insufficient consultation between local and national authorities in instances where local authorities were responsible for action planning, but the measures identified in NAPs would require significant expenditure by public authorities at a national level **(e.g. IE, LT)**.
- In **Greece**, a combination of a lack of adequate budget and administrative capacity, and awareness among civil servants about the problem of environmental noise at receptor, which made it difficult to implement measures that require expenditure**.**
- It was noted by stakeholders in a number of MS (e.g. **DE, IE**) that there is a need for closer cooperation between public authorities in charge of major road and major rail infrastructure *within* agglomerations and the CA responsible for agglomerations

in the action planning process in order to develop more effective strategies and measures to tackle environmental noise at receptor. At present, the main problem identified is that local authorities produce NAPs, but the implementation of the measures contained therein depends on national level bodies responsible for different transport infrastructure, who have the spending power to decide whether measures will be funded. This was mentioned both in interviews and at the workshop.

Cross-border cooperation - Noise Action Planning

Issues were identified relating to the lack of sufficient cross-border cooperation in some MS (see the country fiches for DE, HU). For instance, in HU, whilst in R1, there was cooperation and according to the 2010 country fiche, noise protection measures were put in place to upgrade the three rail corridors in Hungary where there was a cross-border railway crossing (Budapest – Hegyeshalom - Vienna, Budapest – Szolnok – Romania and Budapest – Boda – Slovenia). However, in R2, two of those three major railways NAPs had not been completed and only Budapest- Hegyeshalom. However, there was no cross-border cooperation in the second round.

Public information accessibility – Noise Action Plans

An effort has been made in many MS to ensure that EU citizens have a number of different means available to them in order to obtain copies of draft NAPs to enable them to participate in public consultation. In addition to making NAPs available online, in some instances, hard copies have been made available at the offices of local or regional authorities, public meetings and workshops have been organised and held, and comments registers have been made available in local authority and council buildings. In order to promote awareness about public consultations on NAPs, adverts have been taken out in newspapers and other media to inform the public about these meetings and to provide advance notice that a public consultation will take place.

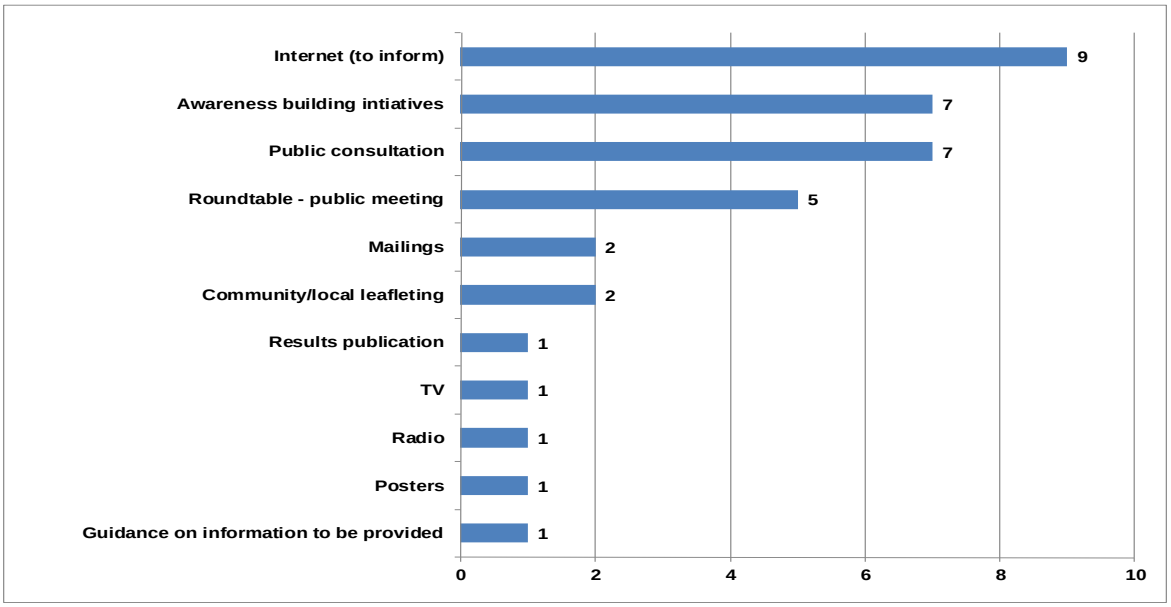
In terms of the **accessibility of public information** and how this has evolved between the two rounds of END implementation to date, the majority of R1 NAPs have been published online. In R2, as detailed earlier, some NAPs for at least one transport mode or for agglomerations were still missing in 23 MS. This means that in those MS, EU citizens, civil society organisations and NGOs do not yet have access to all R2 NAPs, even two years after these were meant to be submitted.

Public consultations on Noise Action Plans

Art. 8 obliges CAs to **consult with the public on draft NAPs** prior to their finalisation. The aim is to provide an early opportunity for the public to participate in the preparation and review of NAPs, with the results taken into account and the public kept informed about the decisions taken. In R2, CAs used a range of mechanisms to meet these obligations, such as publishing draft NAPs on websites (the most commonly used method), holding public meetings and workshops during the action planning process to engage with the public, etc.

The consultation channels that were mentioned by national CAs in the country reports is summarised in the Figure on the following page:

Figure 2.6 - Consultation channels – R2



Source: Own compilation based on 28 country reports

There were a number of findings from the implementation review in relation to how MS manage public consultation processes, and feedback on the extent to which holding consultations has had an effect on improving the quality of NAPs (or not as the case may be). A further consideration was whether consultation procedures have had an impact on improving the outcomes associated with implementing NAPs (and the measures contained therein).

In many EU MS, the **length of the public consultation period to obtain feedback on draft NAPs** was between 4 weeks and 14 weeks. For instance, in **France,** the standard duration of consultations was 2 calendar months. However, examples were also cited of insufficient time being given to review draft NAPs and to provide feedback, such that the effectiveness of the process was considered by NGOs and community groups to have been undermined in some instances. It is inappropriate to name particular MS in this regard, since in some MS, both negative and positive feedback was received with regard to experiences of participating in public consultations.

In terms of how consultations were carried out, typically, these were carried out separately for each individual transport source. However, in the **UK** (**England),** in R2, a public consultation was organised by Defra[66] on three draft Noise Action Plans covering roads, railways and agglomerations (large urban areas) and this was open for 14 weeks (just over 3 months).

Problems were identified in **securing adequate participation from the public and/ or relevant stakeholders such as NGOs/ community organisations** in some MS (e.g. mentioned in EE, EL, FI, HU, NL and the UK), even where the role of public consultation had been well-publicised in advance. CAs confirmed that it was **difficult to obtain a sufficient number of responses** to be considered representative and several stated that they had received very few (or no) responses to public consultations. As a consequence, they regarded the process as being ineffective. Taking the Defra consultation mentioned above as an example, only 23 responses were received to the consultation for the whole of England across all transport modes, although several were received from highly relevant organisations, such as national bodies responsible for roads and railways.

[66] www.gov.uk/government/uploads/system/uploads/attachment_data/file/276066/noise-action-plan-sum-resp-201401.pdf

However, some CAs noted that effective consultation is more about securing informed responses than achieving a high level of response of varied quality. Allocating insufficient budget to consultation was also identified as a problem in some MS. This may limit the visibility and promotion of action planning consultation and thus the quantity and quality of responses.

There were concerns about the **quality of consultation input** among some CAs. It was viewed as being risky to rely on contributions from individual citizens who may not be sufficiently well informed to provide ideas that can be directly incorporated into an action planning document. It was viewed as being more effective to engage with well-established NGOs with the necessary technical capacity to be able to provide a useful input to public consultation.

In terms of **how consultation results are presented**, a common practice was to include consultation responses as an annex to the final adopted versions of NAPs. This approach was seen by stakeholders as having the advantage of ensuring transparency. However, stakeholders observed that not that many NAPs provided a clear explanation or overview as to how feedback has been taken into account. This was confirmed by the study team in reviewing NAPs through the desk research as part of the preparation of 28 country fiches. Some CAs provided a written response to consultation feedback and demonstrated how they had analysed and considered the feedback, but it was often unclear how CAs had dealt with the feedback received.

Several NGO stakeholders interviewed pointed to a **lack of concrete outcomes from their participation in R1 noise action planning consultation processes.** It was not always clear how CAs had used consultation feedback. This has discouraged subsequent public engagement in R2. Conversely, CAs pointed to a lack of public engagement in the first place.

A number of NGOs and local community groups have been interviewed through the research. Among the feedback received in relation to their experiences of participating in public consultations were that:

- There were concerns with regard to the effectiveness of public consultations. There was a perception among some NGOs / community groups that consultation involved going through the motions rather than leading to tangible changes in the final drafts of NAPs.
- There was also concern in some countries that action planning was "all planning and no action", since CAs responsible for NAP implementation often lacked sufficient budget to implement measures included in the NAP. Moreover, since tackling environmental noise is often a secondary rather than the primary driver behind spending decisions, the CA responsible for NAP implementation is often dependent on securing budget from other policy areas to achieve progress.
- The above points were seen as factors potentially reducing the level of participation in public consultations in subsequent rounds of END implementation.
- More positively, even though some NGOs/ community groups were disappointed by the perceived level of impact their feedback had had on the NAP, it was appreciated to at least have the opportunity to review and comment on the NAP.

Despite the weaknesses identified above, there was also some positive feedback about how public consultation has been approached during END implementation in some MS, and about its potential value in strengthening the effectiveness of NAPs.

In some MS (**e.g. FR, DE, LT, LU and NL)**, the research identified evidence of a concerted effort having been made to promote participation in public consultations. Moreover, the feedback received through public consultation was regarded as having been highly useful and taken into account in the revision of some NAPs.

A number of examples of good practices were identified in organising public consultations, as detailed in the following two examples:

Box 2.3 Examples of the role of public consultation

Example 1 – public consultation on R2 NAPs in England

Consultation approach. In England, the consultation process was used by Defra as a mechanism to check whether stakeholders were happy with the overall change in approach to action planning between R1 and R2. For instance, there was a greater focus in R2 on the concept of the identification of "Important Areas" for the purposes of prioritising noise abatement, mitigation and reduction measures. The consultation was used to validate whether this approach was appropriate as well as to ascertain views on whether the approach to quiet areas in agglomerations was seen as the most effective way forward. Three specific questions were put to consultation respondents:

Question 1: Do you agree with the overall approach being proposed for identifying **Important Areas**? If not, what alternative approach would you advocate?

Question 2: Do you agree with the approach being proposed for identifying and **preserving quiet areas in agglomerations**? If not, what alternative approach would you advocate?

Question 3: We have restructured and aimed to simplify the Noise Action Plans covered by this consultation, so that there are three in total covering all roads, all railways and all agglomerations. Are you content with the approach?

Utility of the consultation and any changes made to the NAP. The feedback received was deemed useful in the analysis of consultation responses subsequently published. For instance, some stakeholders noted that "restricting Important Areas to the "top 1%" of those affected could overlook a significant proportion of the population exposed to relatively high levels of transport noise. Some respondents proposed instead extending the definition of Important Areas to encompass a higher percentage of the population; with suggestions ranging from the top five to the top 20%. The outcome was that Defra retained the proposed approach to identifying Important Areas, focussing on the top 1% of those affected by road and railway noise, since this was supported by the majority of respondents. The rationale was that there were likely to be budgetary constraints that precluded extending the approach beyond the top 1%.

Some suggestions made by consultees were however taken into account. For example, in respect of quiet areas in an urban area, the documentation on quiet areas now clarifies that "when preparing quiet area applications, the planning authority may need to liaise with other relevant departments.

In addition, Defra simplified the quiet areas application form and intend to pilot this with a selection of local authorities prior to wider roll-out".

In summary, consultation played a positive role as a mechanism to allow the national CA to obtain feedback directly from stakeholders as to whether they agreed with different aspects of the proposed approach to END implementation in R2.

Example 2 – public consultation on R1 NAPs in Luxembourg

Consultation approach. In Luxembourg, the national CA interviewed emphasised the importance attached to carrying out effective public consultation as a means of ensuring transparency in the finalisation of NAPs. In both R1 and R2, a series of transport-specific consultations were organised.

For instance, in R1, a consultation meeting took place to discuss the draft NAP on major roads and major railways[67]. In the final NAP, a meeting note summarising the proceedings and the comments made during the consultation meeting was provided.

[67] Plan d'action de lutte contre le bruit des grands axes routiers de plus de six millions de passages de véhicules par an, May 2010, http://www.environnement.public.lu/air_bruit/dossiers/BR-bruit/bruit_plans_action/plan_action_routes.pdf

Relevant Ministries and other national public bodies were represented at the consultation meeting, such as the Ministry of Environment, Ministry of Transport, Ministry of Public Works, the national administration for roads and bridges and the national environmental agency. Ensuring that the right actors attended helped to ensure that the consultation process itself was meaningful and useful to participants. Representatives from the commune level also attended the meeting.

Utility of the consultation and any changes made to the NAP. A series of questions were raised at the meeting by participants. Many of the questions were of quite a basic level, but were useful in reassuring the public and community organisations that the NAP had been fully thought through. Participants were then given the opportunity subsequent to the meeting to express their views by providing written comments to any of the 33 communes that are covered through the roads NAP, which were then fed through to the responsible CAs.

The consultation was viewed as useful because it provided a forum to engage with the public and to explain the purpose of the NAP and the measures contained within it. Some more detailed exchanges took place with regard to the views of citizens on particular types of noise mitigation and reduction measures. The need to take into account the diversity of views among citizens was emphasised. For instance, some citizens were in favour of installing noise barriers to reduce noise but others were strongly against because they viewed the barriers as being an eye sore.

Source: own research, based on interviews and desk research

The figure on the following page summarises feedback from public authorities responding to the online survey on **key implementation issues related to action planning**.

Figure 2.7 - When surveyed in 2010[68], those involved in implementing the Directive highlighted various issues related to noise action planning. Please indicate whether the issues identified still apply to your organisation? (n=56)

Source: Online survey of public authorities

[68] This survey question picked up on issues identified in the first legal implementation review and sought to ascertain if the same issues were still problematic in R2 or had been addressed through remedial actions.

As the above Figure shows, good progress was found to have been made between Rounds in respect of core END implementation activities by national CAs, such as coordinating the process of action planning, where 45% of respondents believed that this issue was no longer a problem. However, the position appears to be more nuanced across EU-28 as a whole. For instance, 35% of respondents believed that although there were some improvements, there were still difficulties in respect of action planning.

Among those aspects of END implementation relevant for action planning where there does not appear to have been progress and problems remain are the low level of interest in some MS at local and regional levels in the END, a lack of adequate budget, which was seen as a problem remaining in 58% of cases, and the 12-month timeframe for the development of NAPs (where 53% stated that the problem has remained in both R1 and R2.

2.4 Conclusions

The overall conclusions from the second implementation review are now presented, grouped under a number of different headings:

Legislative transposition

- The END has been correctly transposed into national legislation in 27 out of 28 different Member States (Croatia still needs to ensure that all articles are transposed correctly).
- Although when the first implementation review was produced in 2010, there were some outstanding transposition issues in national regulations, these have been resolved.
- However, there appear to be practical implementation challenges relating to translating some of the definitions used in the END, depending on the national-specific context. For instance, the definition of quiet area in an agglomeration and the concept of an agglomeration itself has posed problems in some Member States.

The overall approach to END implementation

- Reflecting the subsidiarity principle, there are wide differences in the approach to END implementation, with a combination of centralised and decentralised approaches, and wide divergence in action planning approaches.
- The administrative level at which implementation takes place (national, regional and local) also varies between agglomerations, roads, railways and airports.

Designation and delimitation of agglomerations, major roads, major railways and airports

- The transition to the definitive threshold of the END between R1 and R2 has had a material impact on the scope of END coverage for agglomerations, major railways and major roads.
- In most MS, there has been a significant increase in the number of SNMs to be produced and in the case of major roads and major railways, in the volume of noise mapping in km. There has likewise been a significant increase in the number of NAPs to be produced in R2.
- There were not found to be any significant problems in the designation of agglomerations, major roads, major railways and airports, since the thresholds themselves are clear.

- There remain practical challenges relating to the delimitation of administrative responsibilities for noise mapping within agglomerations between national bodies and local authorities in a small number of EU MS. The extent of the problem has been reduced in R2 compared with R1 in most but not all MS, as local authorities have gained experience in implementing the END and in overseeing noise mapping.

Noise limits and targets

- Although there are no common, EU-wide limit values in the Directive itself, national limit values – whether through binding or non-binding targets - were seen as helpful in many Member States since their exceedance was often the basis for prioritising noise mitigation and reduction measures.
- Mandatory noise LVs have been set in 21 MS, with non-binding targets in a further 4 MS[69]. However, the research identified limited evidence of the enforcement of LVs in either R1 or R2.

Quiet areas

- In R1, many MS made progress in the development of a national definition of quiet areas in open country and quiet areas in an agglomeration, supported by appropriate selection criteria to help designate such areas. However, in practice, few EU Member States have yet designated any quiet areas.
- In R2, the majority of MS have yet to designate any (END-related) quiet areas. However, those that have done so have increased the number of quiet areas significantly in R2 compared with R1.
- Whilst recognising the progress already made in the development of good practice guidance on quiet areas by the EEA, there is still a perceived need for the EU to provide further practical guidance as to the types of measures that could be implemented in practice, especially in relation to quiet areas in urban areas.

Strategic Noise Maps

- Overall, good progress has been made in carrying out strategic noise mapping over two rounds of END implementation, although progress still needs to be made by Member States to ensure that SNMs and population exposure data are reported to the EC on a timelier basis across EU-28.
- Data comparability between Rounds and different EU MS is likely to remain a challenge until SNMs are produced using the common noise assessment methods set out in the revised Annex II, Commission Directive (EU) 2015/996 from R3 (voluntary basis) and R4 (mandatory basis).
- Currently, data comparability between rounds is being undermined by differences in the methodology applied to producing noise maps, changes in the modelling software used and computation methods and the difficulty in obtaining reliable and consistent input data.
- Whilst some data has been produced on a comparable and consistent basis for the same source over two successive rounds, comparability is often limited, risking the misinterpretation of population exposure data when presented over consecutive rounds.

[69] Denmark has both binding and indicative values in place, depending on noise source.

- Experiences gained in noise mapping during R1 were seen as having strengthened the familiarity of CAs in coordinating noise mapping, although in both rounds, most CAs have outsourced mapping itself to specialist acoustics consultants with experience in noise prediction calculations on noise exposure and in the use of different national and interim methodologies.
- The EEA Good Practice Guide and national guidance documents has helped to inform the preparation of SNMs in many MS.
- However, in both Rounds, there have been frequent delays at least in some MS in preparing and submitting SNMs and these remain incomplete, particularly for some noise sources in R2. The problem of delays was recognised by CAs in the MS concerned.
- Although most countries have delivered at least some noise maps during R2, as in R1, in some MS, there have been significant delays in the development and submission of SNMs. These were attributed by the MS concerned to ongoing challenges relating to a lack of human and financial resources, and a lack of political will at local level to allocate resources to noise mapping. There was also some evidence of competing political priorities (such as air quality and climate change-related policy measures) for limited resources.
- In some cases, there were delays in budget being approved and made available for noise mapping purposes, due to the economic and financial crisis. Whilst the economic crisis may be over in many EU Member States, there are medium-term consequences, such as public sector budget cuts being implemented over a prolonged period of time, which have led to delays in getting R2 noise mapping underway in several Member States (e.g. EL, ES and PT).
- There remain administrative implementation challenges in some EU MS, such as overly complex administrative arrangements and division of competencies for noise mapping, especially within agglomerations. In some MS, especially those with a strongly decentralised implementation structure, many local actors are involved and there has sometimes been a lack of effective central coordination.
- The input data necessary for noise mapping was not always available either in R1 or R2, although there have been improvements in the availability of data in R2. This has implications for data comparability between MS. For instance, in some MS, data on the average number of people per dwelling is available, whereas in other cases, it is based on estimates produced by acoustics consultants. This impacts on the consistency and comparability of data.
- Almost all MS that have developed SNMs in both R1 and R2 made these available online. However, the delays in R2 have meant that some SNMs are still not easily accessible online by EU citizens and NGOs/ community organisations.

Noise Action Plans

- There have been delays in the submission of R2 NAPs in several MS. Reporting information on data completeness shows that NAPs are particularly incomplete for railways and airports.
- In the case of agglomerations, a particular problem was identified in EU Member States with a decentralised approach to END implementation. It was found that the more CAs and other public bodies that are involved in noise action planning, the more difficult it is to ensure effective coordination of noise action planning processes.
- The timescale of 12 months between the deadline for the submission of SNMs and the deadline for the submission of NAPs to the EC was widely viewed as being too short to allow sufficient time for liaison and discussions between different CAs involved in action planning, to carry out public consultations and to

take the feedback obtained through public consultation into account in NAP finalisation.

- Since the END is implemented under subsidiarity, there were found to be wide divergences in the approach to action planning between MS. For instance, there are significant differences in the length of NAPs and in their level of ambition and in the types of measures identified to promote noise mitigation, abatement and reduction, in the level of expenditure that the implementation of measures would require etc.
- Whilst in some MS, a strategic approach has been adopted to the development of NAPs, in others, there has been a more operational focus, through the development of very detailed NAPs.
- A number of weaknesses were also identified in NAPs. Many NAPs do not include cost-benefit information, even though this is listed in Annex V as information to be provided "if available" (minimum requirements for NAPs) under the 'financial information' section. Some NAPs include the projected costs, but contain no information about the expected benefits.
- Although national guidance has been produced in many EU MS, the lack of EU-level guidance on NAPs was seen as a shortcoming which if addressed could help to improve the quality of NAPs, especially in problematic areas such as the section on cost-benefit.
- There has been broad continuity in the types of measures identified in NAPs between R2 and R1. This was viewed as being appropriate, given the need for a long-term approach to environmental noise management and to effective practices in noise mitigation, abatement and reduction.
- The difficulty in identifying dedicated budget for noise mitigation and reduction measures was cited as among the main implementation challenges in implementing the measures set out in action plans.
- There was a recognition that public engagement in action planning through participation in public consultation processes remains a weak spot that needs to be improved in many EU MS.
- Many CAs interviewed stated that they had received very few or no public consultation responses. Consequently, they regarded the quality of input to strengthening NAPs as being ineffectual and the process as being ineffective.
- Whilst in some cases, it was made clear by CAs how consultation feedback had been taken into account, and whether this had influenced NAP finalisation, in many cases, NGOs and community organisations were unclear how consultation had been considered and whether it had any impact.
- More positively, there were at least some examples of the effective use of the results from public consultations in some EU MS (e.g. **FR, LU** and the **UK**, among others). Consultation feedback was often summarised either in the NAP itself or as an annex to the NAP, which over time should help to strengthen transparency and accountability.

3. EVALUATION OF THE END

This section sets out the rationale for carrying out a REFIT evaluation of Directive 2002/49/EC ("the END"), the evaluation's objectives, and methodological challenges. The findings from the assessment of the intervention logic underlying the Directive are set out. The assessment of key evaluation issues and the main findings in relation to *relevance, coherence, effectiveness, efficiency* and *EU added value* are then outlined.

3.1 The evaluation of Directive 2002/49/EC

3.1.1 Rationale for a REFIT evaluation of Directive 2002/49/EC

Through REFIT, the EC is undertaking systematic assessments of all EU environmental legislation in order to check its "fitness for purpose". In 2013, the EC announced in its Communication on Regulatory Fitness and Performance programme (REFIT)[70] that an **Evaluation of the Environmental Noise Directive** (Directive 2002/49/EC) or the "END") would be undertaken to assess the Directive's regulatory fitness. Such evaluations provide an evidence-based critical analysis of whether EU actions are proportionate to their objectives and delivering as expected. They cover environmental, economic and social aspects.

REFIT is part of the EU's **Better Regulation agenda** and its purpose[71] is to "cut red tape, remove regulatory burdens, simplify and improve the design and quality of the legislation so that EU policy objectives are achieved, and the benefits of EU legislation are enjoyed at lowest cost and minimum administrative burden, in full respect of the Treaties, particularly subsidiarity and proportionality".

REFIT also emphasises the importance of checking that EU legislation pursues policy objectives that could best be achieved at an EU level. The importance of identifying any possible gaps and loopholes, inconsistencies, uncertainties and ambiguities in EU legislation has also been stressed in earlier Communications on Better Regulation. These are important considerations when assessing the END.

In the May 2015 Better Regulation Package, the EC adopted a new Communication[72] which states that "applying the principles of better regulation will ensure that measures are evidence-based, well-designed and deliver tangible and sustainable benefits for citizens, business and society as a whole". The 2015 guidelines on Better Regulation[73] have also been taken into account in the development of this evaluation report, in particular "Chapter VI - Guidelines on evaluation and Fitness Checks".

The evaluation focuses on the period of implementation since the Directive's adoption until November 2015 and takes stock of the extent to which progress has been made towards the achievement of its objectives. However, some forward-looking 'prospective issues' as to how environmental noise policy could be further developed, and the legislation's efficiency and effectiveness improved in future arose and are also mentioned in the report.

In the Tender Specifications, the EC set out the key evaluation criteria and questions to be addressed. Further sub-evaluation questions were developed by the evaluation team. The amended list of evaluation questions is provided in Appendix G.

[70] Regulatory Fitness and Performance (REFIT): Results and Next Steps, COM(2013)685 final

[71] Communication on Regulatory Fitness and Performance Programme (REFIT) (COM(2014) 368 final)

[72] Better Regulation for Better Results - An EU agenda, COM(2015) 215 final, 19.5.2015

[73] http://ec.europa.eu/smart-regulation/guidelines/docs/swd_br_guidelines_en.pdf

3.1.2 Evaluation criteria

The key evaluation questions specified in the Tender Specifications were grouped around the core set of five evaluation criteria in EU guidance on evaluation[74]:

- **Relevance** - the extent to which the END's objectives remain pertinent to needs, problems and issues to be addressed;
- **Coherence -** whether the definitions in the legal text are coherent and the obligations clear, whether the articles in the Directive are consistent (**internal coherence)** and the extent to which the END remains coherent with other relevant EU legislation, notably the noise at source Directives (**external coherence)** and;
- **Effectiveness -** the extent to which the END's two objectives set out in Art 1(1) and 1(2) have been achieved to date, the speed of progress and any barriers to achieving objectives. The efficiency of management and implementation and reporting arrangements is also considered;
- **Efficiency** - the extent to which desired effects are being achieved at reasonable cost (i.e. determined through an assessment of the costs and benefits); and
- **EU added-value** - the value added of action at EU level that would be difficult or impossible to achieve through national level actions in the area of environmental noise alone.

In addition, the following issue is relevant across all evaluation criteria:

- **Fitness for purpose –** checking whether the END is fit for purpose and provides a "simple, clear, stable and predictable regulatory framework" is an important overarching issue within a REFIT context.

The evaluation questions were then further developed to determine appropriate sub-questions. The ordering of evaluation issues was revised to reflect the END's underlying intervention logic, starting with the more strategic issues of relevance and coherence, and moving on to the issues of efficiency and effectiveness, which have both an operational and a strategic perspective. The Directive's overall EU added value is then considered. A complete set of evaluation questions ("EQs") and sub-evaluation questions is provided in Appendix G.

It should be noted that in order to address the criteria of effectiveness, efficiency and EU added value, the analysis draws largely on the findings from the interview programme, the online survey and the quantitative case study research, whereas for the assessment of relevance and coherence, the research has necessarily drawn not only on stakeholder feedback but also to a larger extent on desk research. In particular, we have undertaken a review of relevant EU legislation on noise at source and other documentation. The bibliography consulted by the study team is provided in Appendix B. Stakeholder views on the intervention logic diagram were also sought through a validation workshop to discuss the evaluation findings held in September 2015.

[74] http://ec.europa.eu/smart-regulation/evaluation/docs/20131111_guidelines_pc_part_i_ii_clean.pdf

3.1.3 Methodological approach for the evaluation

A summary of the evaluation methodology was provided in Section 1.7.

In terms of the targeting strategy for stakeholder consultations, the objective was to ensure that across the different research methods and data collection tools, as wide a range of END stakeholders as possible were consulted. National CAs in all EU MS were targeted, not only to contribute to the completion of country reports (see Section 2), but equally, to feed into the evaluation. A contact database was developed of a wider range of CAs and other relevant END stakeholders. An invitation to complete the online survey was sent out.

In terms of the structure of the interview programme, the focus was on ensuring that a broadly representative range of stakeholders involved in END implementation were consulted, with a greater focus on CAs directly involved in reporting to the EC, and in strategic noise mapping and action planning but also other public authorities, for instance, those that provide input data to facilitate noise mapping, as well as NGOs and community organisations that have taken part in public consultations on NAPs. In order to ensure that the stakeholder consultations to inform the evaluation research were as inclusive as possible, following the validation workshop, written submissions on the working documents published were welcomed from both workshop participants and non-participant stakeholders unable to attend. Written responses were received from approximately 20 END stakeholders, and these were then analysed.

3.1.4 Methodological challenges in evaluating the END

Before outlining the findings, the main methodological challenges in evaluating the END and assessing its key achievements are outlined in the following table (see second column). In the third column, examples of ways in which these problems have been at least partially overcome is provided.

Table 3.1 - Methodological challenges in evaluating the END

Heading	Key issues	Overcoming challenges
Evaluability	• There are challenges in assessing the END's contribution to mitigating and potentially reducing the level of environmental noise and the adverse health effects of high levels of environmental noise since reducing environmental noise is not an explicit objective, but remains implicit in the recitals. Moreover, although measures are required to be included within noise action plans, implementing these is not mandatory. • Environmental noise at receptor is a MS competence under the principle of subsidiarity. Since the END has been implemented quite differently in different MS, this poses challenges in assessing the efficiency and effectiveness of its implementation overall at EU level. For example, in comparing administrative costs between MS, due attention needs to be paid to the corresponding implementation approach. Otherwise a	• Assessed progress towards a common approach, which although an intermediate, process-driven objective, is still an ambitious objective. • To some extent, the risk of direct comparison has been overcome by clustering groups of MS together that have adopted a similar approach to END implementation to compare "like with like".

Heading	Key issues	Overcoming challenges
	direct comparison could be misleading.	
Attribution	• In assessing the END's achievements, there is a need to consider the extent to which the costs and benefits incurred can specifically be attributed to the END, as opposed to other drivers, such as the existence of pre-existing national regulatory requirements. • Moreover, whilst some measures identified in NAPs have been specifically developed as a result of the END, in many cases, the primary driver of identifying funding for measures is not environmental noise but for instance air quality, road safety, planned transport or road infrastructure improvement. • Whilst there are evidently important secondary benefits for noise mitigation, abatement and reduction, this raises the question of what percentage of the cost and benefit should be attributed to the END and introduction of an action planning versus what would have gone ahead anyway. • The desk research and interviews showed that many measures included in R1 NAPs were planned before the END came into effect (e.g. long-term transport infrastructure upgrading).	Attribution issues factored into quantitative case study and CBA work. Sensitivity analysis was undertaken to assess how costs-benefit ratios would change under different modelling scenarios of 25%, 50% and 75% attribution effects. Attribution taken into account qualitatively through interviews when stakeholders were asked for their views as to whether measures could be attributed to the END either fully, partially or not at all.
Balance between quantitative/ qualitative evidence	• DG ENV put a strong emphasis on assessing the END's cost-efficiency through an assessment of the administrative costs and a review of the costs/ benefits of individual measures and an extrapolation to EU level through a CBA. • In assessing cost-effectiveness, however, various stakeholders stated that it is equally important to assess the benefits and impacts of the END qualitatively since a strict focus on quantifiable benefits (which cannot always be easily attributed to the END, see previous point) risks underestimating the benefits. • Examples were cited of the benefits of adopting a more strategic approach to managing environmental noise that extend beyond the quantifiable benefits.	Important that both quantitative and qualitative aspects are taken into account in assessing the Directive's achievements to date. The assessment of effectiveness and impacts provide selected examples of the non-quantifiable strategic benefits of the END.

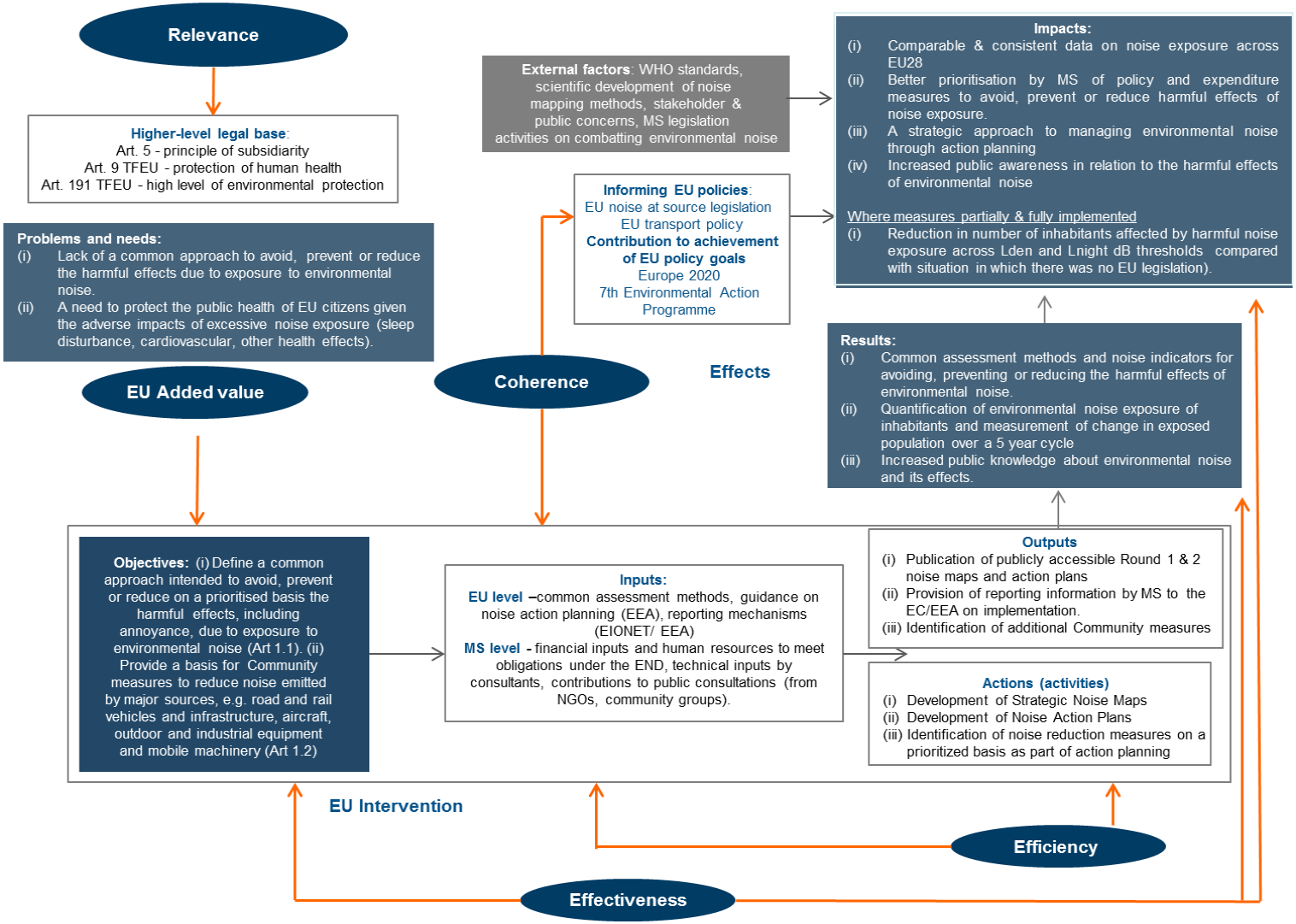
3.1.5 Intervention Logic

The purpose of assessing the "Intervention Logic" was to critically reconstruct the Directive's "theory of action" when it was adopted in 2002 and to ascertain whether the way in which the logic was meant to work actually works in practice in light of actual implementation experience. More specifically, the aims of logic mapping were to:

- Provide an analysis of the rationale for the Directive by identifying the needs, problems and issues that the END is seeking to address.
- Identify the END's objectives and the expected results (under a future scenario in which the Directive is fully and effectively implemented).
- Identify how EU intervention in the field of environmental noise relates to the evaluation criteria of *relevance, coherence, efficiency, and effectiveness* and *EU added value.*
- Assess the relationship between the Directive's objectives, inputs (human and financial resources), and how these translate into outputs, results and impacts.

The intervention logic diagram on the following page shows the inter-linkages between the Directive's two objectives, the implementation actions that MS must carry out (e.g. Strategic Noise Mapping, making information accessible to the public and Noise Action Planning) to contribute to the achievement of these objectives and the expected **outputs** (immediate outcomes), **results** (intermediate outcomes) and **impacts** (longer-term outcomes) if the Directive were to be fully and effectively implemented. As such, the schematic framework set out in the logic diagram is relevant to all evaluation criteria.

Figure 3.1 – Intervention logic diagram showing the theory of action of the END



As a reminder, the two core objectives of the END are set out in Art. 1(1) and 1(2) and are as follows:

- Art. 1(1) - Define a common European approach to **avoid, prevent** or **reduce** the effects of exposure to environmental noise harmful for health, which includes annoyance and to "preserve environmental noise quality where it is good".
- Art. 1(2) – Provide a basis for **developing Community measures to reduce noise emitted by major sources,** in particular road and rail vehicles and infrastructure, aircraft, outdoor and industrial equipment and mobile machinery.

Among the findings in respect of **relevance** were that the two objectives of the END described above remain highly relevant to identified needs. However, the objective set out in Art. 1(1) of defining a common approach to noise assessment methods and to measuring dose response relationships is of an **intermediate nature.** The END, then, stops short of establishing a strategic objective that the Directive's implementation should ultimately lead to, such as reducing environmental noise to alleviate the adverse public health impacts of high noise levels, although this is somewhat implicit in the recitals.

The second objective, **informing the development of EU source legislation**, also remains highly relevant since there remains a need to gather accurate and comparable population exposure data in order to facilitate evidence-based policy making for noise at source legislation.

Turning to **(external) coherence,** the END was therefore viewed as being strongly coherent with, and complementary to, EU noise at source legislation. Tackling noise at receptor and at source in parallel was viewed as remaining strongly coherent. There was broad consensus among stakeholders that:

- The END provides a strategic framework and common approach through which measures at local level can be taken to address noise at receptor.
- Source legislation has an important role to play in parallel since there is potential scope to reduce noise levels by a greater degree of magnitude than commonly possible through measures at receptor.

With regard to **(internal) coherence,** the coherence of the Directive's legal text itself was examined and the extent to which the requirements and definitions were seen to be clear.

Overall, the requirements and obligations set out in the END were found to be broadly consistent. However, there are some aspects of the legal text itself where END stakeholders perceived there to be a lack of clarity and this may serve to undermine the internal coherence of the legal text. Examples are:

- The definition of an agglomeration could be made clearer, and / or supported by further guidance from the EC, since some Member States have struggled with this concept.
- References in different articles of the Directive to the requirement to "draw up" an Action Plan, whereas elsewhere in the END, there is a reference to the adoption of Action Plans.

Turning to **effectiveness,** i.e. the relationship between objectives and outcomes, the diagram illustrates under the 'results' box the expected intermediate outcomes arising from the END's implementation. The desk research and interviews have confirmed that whilst significant progress has already been made towards a common approach, supported by a transition towards comparable data, completing the technical process of developing a common approach to noise assessment methods (Annex II) and to the

development of revised dose response relationships (Annex III) is a long-term process reflecting its technical complexity. Indeed, most stakeholders commented that the process of moving towards a common approach will require a 20-25-year long-term commitment by the EU and the MS.

Moreover, the END has been effective in providing the basis for informing existing noise at source legislation. Indeed, population exposure data has already been produced and was regarded by EU policy makers as being useful, but its effectiveness is currently still limited by data comparability and incompleteness which has prevented it from being used more extensively.

The **efficiency** criterion in the diagram links the *"inputs",* which relate to the costs of implementing the END (administrative costs and the costs of measures identified in NAPs) and the actions required (i.e. the preparation of noise maps and action plans) to the *"outcomes"* in order to assess whether the benefits (outcomes) justify the costs (inputs). The findings from the assessment of administrative costs and in relation to the cost-effectiveness of measures were assessed through the CBA and case study research. The findings from the CBA have also shed light on the relationship between inputs and outputs, and are set out in Section 3.2.4.5 - Findings from the cost-benefit assessment (EQ13).

As far as **European Value Added** is concerned, i.e. the question if the END has triggered actions and delivered results which would not have been realised in its absence, the transition towards a common approach to common noise assessment across the EU is inherently European in nature. It would not by definition be possible to achieve what the END is trying to do through a purely national approach, since even if some MS already produced noise maps and monitored the problem prior to entry into force of the END, they did not do so on a common basis. The END therefore demonstrates strong added value. The intended logic when the END was adopted was that the END's implementation would eventually lead to the production of comparable data to inform EU noise policy in general and noise at source legislation in particular. During implementation, it has become apparent that whilst considerable progress has already been made, the full value of a European approach has not yet materialised, given that the timescale for full comparability will only be achieved for Round 4.

3.2 Key evaluation findings

In the subsequent sections, the different key evaluation criteria - *relevance, coherence, effectiveness (impacts), efficiency* and *EU added value* are assessed. The evaluative assessment draws on feedback received through the online survey, the interview programme, the validation workshop and the written responses received on the working papers produced for the workshop that summarised the evaluation findings. An overview of the approach to targeted stakeholder consultation, and the balance between different types of research inputs was described in the methodological overview in Section 3.2.4.5 - Findings from the cost-benefit assessment (EQ13).

3.2.1 Relevance

Relevance examines the relationship between objectives and identified needs. In a REFIT context, the Directive's continuing pertinence in light of developments in the 13 years since the END was adopted has been assessed. In analysing relevance, it is important to distinguish between the needs of different stakeholders since these differ between:

- **The needs of EU policy makers** responsible for noise at source policies who need reliable and ideally comparable population exposure data in order to determine the magnitude of noise at receptor and the (net) benefit of existing source legislation. Moreover, a robust evidence base is essential before existing source legislation can be made more stringent or new legislation can be proposed.

- **The needs of national policy makers** responsible for environmental noise policy at receptor, who appreciate the opportunity to benchmark population exposure data.
- **The needs of regional and local authorities –** who need to determine the scale of the problem in order to put forward appropriate noise reduction, mitigation and abatement measures at local level.
- **The needs of EU citizens** who require better information about the extent of population exposure and the adverse effects of high levels of noise.

The specific evaluation questions examined in relation to relevance were:

EQ1- Are the objectives of the Directive still relevant?

EQ1a - How far does the Directive meet identified policy needs (e.g. high levels of environmental protection, human health)?

This question assesses whether the END still meets the needs of EU policy makers in **preventing, mitigating and reducing the health effects of environmental noise**.

Among the feedback received was that collecting population exposure data by individual transport source remains highly relevant to EU and national policy makers firstly to address the problem of the lack of EU-wide comparable data. Secondly, the collection of exposure data through noise mapping remains essential because it enables EU and national policy makers to better assess the scale of the problem. This was seen by interviewees as an essential pre-condition for being able to then properly assess the magnitude of adverse health impacts of excessive noise exposure such as sleep disturbance, cardiovascular disease and other known effects on health and quality of life.

The **objective of Art. 1(1) of a "common approach"** to the assessment of environmental noise using common indicators remains highly relevant in the opinion of many END stakeholders. There is widespread acceptance among stakeholders at national level of the need to carry out strategic noise mapping to provide evidence of population exposure at both MS and EU level. However, not all stakeholders especially at local level fully recognised the importance of adopting a "common approach" to the assessment of environmental noise. This reflects the fact that harmonised data is predominantly needed for European/national strategic purposes rather than for local decision-making purposes. This view is common amongst stakeholders involved in local decision making and is more frequently encountered in those MS that have long-established national noise policies and legislation prior to the END, and in MS with existing procedures to remedy noise problems at the local level.

For instance, interviewees in **Denmark, France** and the **Netherlands** pointed to difficulties in persuading local authorities across the board to cooperate in a timely manner and to provide input data for noise mapping. Where the local authority was responsible for mapping, there were sometimes examples of them not producing noise maps at all, even if this was required. This was in turn linked to their perceptions of noise mapping as being costly with little practical benefit given a lack of dedicated budget to implement measures in many MS. However, this can be contrasted with larger city authorities, who viewed noise mapping as remaining highly relevant to their strategic policy making needs (for instance, in relation to urban development and planning, the creation of quiet areas, etc.).

Many stakeholders interviewed commented that although the objective of a common approach remains relevant, this is an **intermediate objective.** At the validation workshop, it was confirmed that the END's relevance is undermined due to the fact that it does not set out a clear longer-term public health-based objective against which to evaluate its "relevance" (e.g. "reducing the number of EU citizens exposed to environmental noise above dB threshold X"). This finding emerged from the desk research to assess the intervention logic, but was then subsequently confirmed through

both the interview programme and validation workshop. Several workshop participants commented that whilst the END remains relevant, the focus is on the process (a "common approach"), with a lack of a clear strategic goal that would concentrate CAs' focus on what the Directive is ultimately trying to achieve.

The **implicit, longer-term objective of the Directive is to protect public health** (c.f. Art. 9, TFEU) and to ensure a high level of environmental protection (c.f. Art. 191, TFEU). Indeed, Recital 1 of the END states that *"It is part of Community policy to achieve a high level of health and environmental protection, and one of the objectives to be pursued is protection against noise. In the Green Paper on Future Noise Policy, the Commission addressed noise in the environment as one of the main environmental problems in Europe".* The data collected through noise mapping to date suggests that since a high number of EU citizens remain exposed to potentially harmful effects due to noise exposure at receptor, this implicit aim remains highly relevant.

The **objective of Art. 1(2) of providing a basis for developing Community measures to reduce noise emitted by major sources,** was viewed by most stakeholders (national, regional and local) as remaining highly relevant to identified needs. It was acknowledged that whilst environmental noise at receptor should be tackled through local level measures, such measures could be ineffective without additional controls over noise emitted by the major sources of noise, particularly given the growth in the number of such sources (e.g. increases in road traffic and aircraft movements). The collection of adequately harmonised and standardised data at EU level was regarded by the majority of stakeholders (85% - 90%) as being an important pre-requisite for strengthening the evidence base for reviewing existing EU noise at source legislation.

However, not all stakeholders were aware of the inter-relationship between strategic noise mapping under the END, data reporting requirements and the development of noise at source legislation (circa 15% were unaware). Several stakeholders expressed the view that the first objective of the END (Art. 1(1)) was the core objective, and viewed the requirement to report data as being secondary to the challenge of managing noise at local level.

There is some differences of opinion amongst stakeholders as to whether reporting data should be used primarily to influence noise at source legislation (Art. 1(2)) or should also be used to **make comparisons as to the acoustic conditions between MS** (Art. 11). There were concerns among some stakeholders that comparisons between MS would be inappropriate given that acoustic conditions vary widely, are local-specific and that the CNOSSOS-EU methodology, as set out in the revised Annex II (Commission Directive (EU) 2015/996) has not as yet been implemented so there is a lack of fully comparable data.

Accordingly, from a relevance perspective, several stakeholders noted that comparisons of changes in population exposure *between rounds* in a given EU country are more relevant than *cross-country comparisons* between EU MS. Some interviewees, especially from smaller MS such as **Luxembourg**, stated that care needs to be taken in presenting reporting EU-level data on population exposure since cross-country comparisons may not always be comparable. Moreover, the domestic media and local citizens may not have the full context to interpret the data. For instance, the Noise in Europe 2014 report that "In small MS like Belgium, Luxembourg and Malta, the share of quiet areas is very low and noisy areas represent a significant portion of the protected areas". According to an interviewee in Luxembourg, presenting Luxembourg as noisy due to high population exposure relative to its population size was viewed as not representing the situation in a proportionate manner.

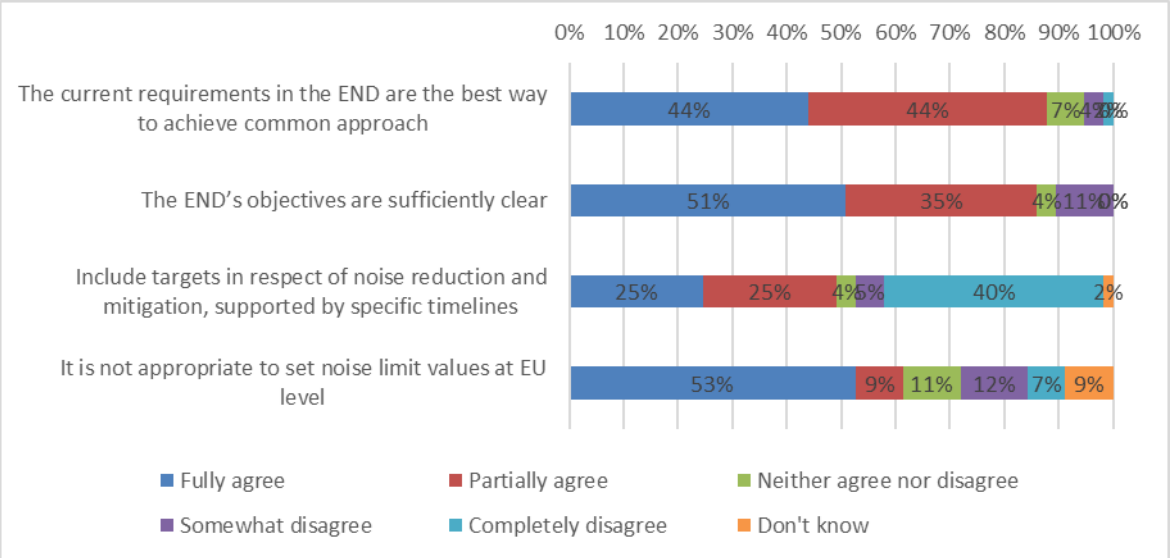
From an EU citizen's perspective, whilst noise mapping requirements and the collection of population exposure data over time is potentially very relevant to citizens' needs, the maps and data produced through the END are of a technical nature, and as such are not user-friendly in terms of citizens' understanding of what they depict.

It was observed by many stakeholders (particularly NGOs/ community organisations but also acoustics consultants) that the public does not generally understand the L_{den} and L_{night} indicators, which in turn undermines the relevance of noise maps published. Moreover, making noise maps available showing population exposure data by individual transport source was **seen as not reflecting citizens' actual experience of noise**, which is (i) cumulative across several transport sources and (ii) specific to living in a particular locality. Some stakeholders (interviewees, workshop participants) pointed to the low level of downloads of noise maps as being testament to this problem, which undermines the relevance of SNMs to EU citizens.

Although some health benefits will emerge from the END's implementation, since there is no mandatory requirement to implement measures, the full health benefits will only be delivered in a subsequent, currently unspecified, stage. This was viewed by some stakeholders as undermining relevance, although others argued that continuing to allow MS to determine national approaches to the development of measures to tackle environmental noise impact was in full accordance with subsidiarity.

Online survey participants were asked to comment on statements related to the appropriateness of the END's objectives. 88% of respondents either fully or partially agreed that the current requirements in the END were the best way to achieve the END's first objective of a common approach. Half the respondents also agreed that the Directive's objectives were sufficiently clear, while 11% somewhat disagreed.

Figure 3.2 – Given the END's objectives, how do you rate the following statements? (n=57)



Source: Online survey of public authorities

A number of public authorities interviewed maintained that the Directive's relevance could be strengthened if a holistic approach were to be adopted with regard to noise management, including an integrated approach that combines noise and other environmental issues, notably air quality. The scope for potential synergies between Noise Action Plans under the END and Air Quality Action Plans under the Air Quality Directive was also raised.

In summary, the key findings in respect of relevance were that:

- The first objective of the END remains relevant in the opinion of many END stakeholders, particularly those involved at a national level, who recognise the need for a "common approach" to the assessment of environmental noise.
- The collection of adequately harmonised and standardised data at EU level remains an important and relevant pre-requisite for strengthening the evidence base for reviewing existing EU noise at source legislation (the second objective).
- The importance of a "common approach" is not as well recognised in MS with pre-existing noise legislation and policies, or by stakeholders involved at a local level. This suggests that the EC's DG ENV (supported by the EEA) may need to strengthen communications with national stakeholders as to the importance of a common approach in leading to comparable data that can influence source legislation.
- The END's strategic relevance is being undermined by the lack of a strategic, longer-term objective not currently focussed on delivering longer term policy needs, such as the protection of public health. As the Directive currently stands, it only indirectly addresses environmental and health protection by seeking to influence noise at source legislation (Art. 1(2)), but relies on the MS to fund and implement environmental noise abatement and reduction measures at receptor. Although this is in line with subsidiarity and the respective competences of the EU and MS, there is a question as to whether it is sufficiently clear what the END is meant to achieve over the longer term.
- Overall, the two "objectives" specified in Art. 1(1) and Art. 1(2) remain pertinent to policy needs, problems and issues that the Directive was meant to address.

A further evaluation sub-question analysed under relevance was **EQ1a - How far is the Directive relevant to identified policy needs?** Since the previous question partly addressed this issue, the analysis provided below is restricted to the key points only.

The review of the intervention logic (see Section 3.1.4) found that the END has been designed in a way that is broadly relevant to meeting identified EU policy needs, which include ensuring high levels of **environmental protection and protection for human health.**

The assessment of the END's relevance to EU policy needs took into account the EU legal base, which is set out in primary legislation in the Nice Treaty. The END refers in recital 1 to Art. 175(1) of the Treaty (the Environment Title of the Treaty). This emphasises the importance of the subsidiarity principle. It states that:

"The Council, acting in accordance with the procedure referred to in Art. 251 and after consulting the Economic and Social Committee and the Committee of the Regions, shall decide what action is to be taken by the Community in order to achieve the objectives referred to in Art. 174".

Recital 7 emphasises that the rationale for the Directive is underpinned by the Treaty objectives of **achieving a high level of protection of the environment and of health** which will be:

"Better reached by complementing the action of the Member States by a Community action achieving a common understanding of the noise problem. Data about environmental noise levels should therefore be collected, collated or reported in accordance with comparable criteria. This implies the use of harmonised indicators and evaluation methods, and criteria for the alignment of noise-mapping. Such criteria and methods can best be established by the Community".

The primary EU legal base has evolved since the Directive was first adopted. The **Treaty of Nice has been replaced by the Treaty of Lisbon** which came into force in

December 2009. This means that the articles and terminology will need to be changed if the Directive is revised to be brought up to date in future. For instance, the Environment Title of the Treaty was formerly ex-Articles 174–176 TEC and these have now become Articles 191–193. On terminology, Community action should become 'EU action' and Community measures should be referred to as 'EU measures'. These are minor issues but worth pointing out since the legal base for the Treaty has evolved since the END was adopted. This issue is picked up in further detail under 'coherence'.

Overall, the research found that the END remains relevant to EU policy-making at a number of different levels:

- **Informing EU environmental noise policy and noise at source legislation** – although MS have competence in respect of environmental noise, the EC needs to gather data and reporting information to inform the development of new, and the revision of existing noise at source legislation, where the EU has legal competence. The focus on generating comparable data prepared using a common approach should help the EC to identify areas where it is best placed to play a coordination role and to take complementary action "to achieve a common understanding of the noise problem" (c.f. recital 7).
- **Informing EU**– the END is relevant in supporting EU legislation on noise at source by providing data on changes in population exposure over time and to determine appropriate baselines.
- **Developing a better understanding across the EU of the impact of environmental noise at receptor on human health**. There is a focus through Annex III on developing "assessment methods for harmful effects". This will require the development of European guidance on dose-response relationships (and it is planned that this will take into account WHO guidance and scientific and technical progress to assess the health effects). Until the scale of the problem and the health effects are more accurately assessed, the END cannot maximise its role in informing source legislation by providing a quantitative evidence base to do so.

The END was also found to be relevant to **national policy making**. Stakeholders commented, for instance, that the END was pertinent in the following ways:

- Collecting data on the number of exposed persons to high levels of noise provides an **appropriate baseline** that can be monitored on a consistent basis over five yearly cycles;
- This enables MS to **benchmark their performance** over time and to assess the effectiveness of any environmental noise policies and measures being adopted at national level. It potentially should also facilitate comparisons with other EU MS but this is presently limited due to differences in approaches to data collection and measurement (e.g. a combination of national and interim methods in Annex II) until Commission Directive (EU) 2015/996 that replaced Annex II has been fully implemented.
- Action planning was also viewed as being relevant to facilitating a benchmarking approach i.e. MS CAs can observe what types of measures are being used to tackle environmental noise in other EU MS.

It should be noted that the utility of data collected through the END in informing EU policy development on noise at source legislation and national environmental policy development is considered later in the report under "effectiveness".

3.2.2 Coherence

The following aspects relating to coherence have been examined through the research:

- **External coherence -** the coherence between:
  - The END and EU legislation on noise at transport source;
  - The END and other EU legislation that addresses noise; and
  - The END and national policy and legislation on environmental noise.
- **Internal coherence –** the extent to which the legislative text of the END is internally coherent e.g. clarity of the Directive's legal text, definitions, consistency between articles and sub-articles and the requirements of MS CAs.

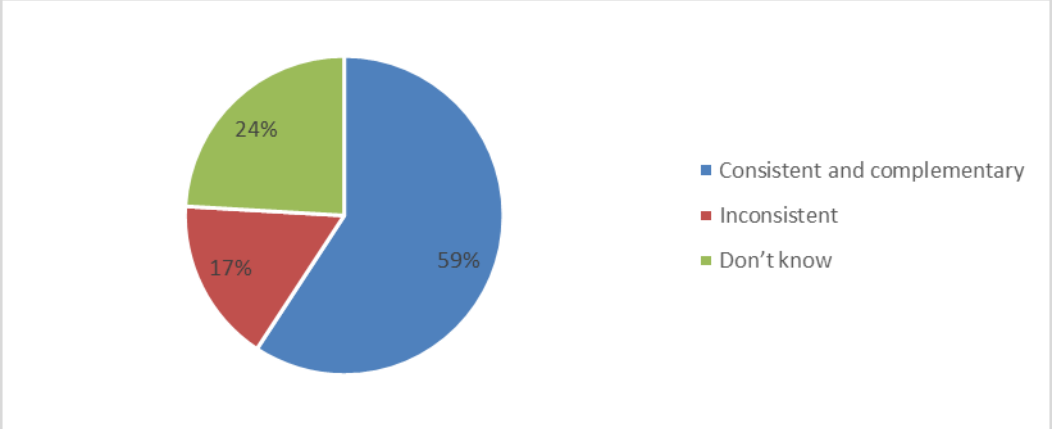
The assessment begins with a review of the findings in respect of 'external coherence'.

3.2.2.1 Coherence of the END and other EU source legislation

EQ2 - How far is the Directive coherent and consistent with other EU legislation (e.g. noise at source legislation overall and source legislation by transport type i.e. automotive, railways, aviation)?

The extent of coherence between the END and EU noise at source legislation was examined. The survey results showed that the END is regarded as being consistent with, and complementary to other EU legislation by the majority of respondents from public authorities (59%).

Figure 3.3 – Which of the following statements best describes the relationship between the END and other EU noise legislation? (n=54)



Source: Online survey of public authorities

Only 17% stated that the legislation was inconsistent, which the interviews subsequently found was because not all END stakeholders are aware of the inter-relationship between the END and the importance of collecting population exposure data across the EU to inform the revision of existing and the development of new EU source legislation. The interview feedback broadly confirmed the findings from the online survey. The relationship between the END and noise at source legislation was seen as **symbiotic and mutually supporting** by the majority of stakeholders.

Most stakeholders were clear that source legislation is 'top-down' and plays an important role in tackling the problem, but stressed that it is equally important to address noise at receptor through local measures and to collect population exposure data to inform EU policy makers as to whether the net benefit of existing source legislation for different transport modes (e.g. roads, railways and airports) is sufficiently stringent.

A number of stakeholders mentioned that coherence between the END and source legislation could be further strengthened by ensuring that the END (and the data collected on population exposure through noise mapping) is more explicitly taken into account in revising EU source legislation.

However, the desk research and interviews with EU policy makers however found that the END has already been having an important effect on the revision of source legislation. For instance, in the past three years in particular, the END has been mentioned in the recitals of a number of different pieces of EU source legislation for different transport modes, especially legislation in the automotive and aviation sectors. Moreover, a number of impact assessments carried out in respect of revisions to EU source legislation in the automotive and railways sectors[75] have made explicit reference to the END as a strategic reference point. They have also highlighted the central importance of data on population exposure in informing what action should be taken. Reference should be made to the detailed mapping of references to the END in recent revisions of source legislation, as outlined in Section 3.2.3 - Effectiveness (and impacts), in particular EQ8 (which outlines key findings in relation to progress towards achieving the END's second objective, which contains a summary mapping of relevant legislation and the extent of references to the END).

The evaluators however found that ensuring that all source legislation is more systematically and explicitly linked to the overarching framework provided by the END is a long-term process. It was observed as part of the legal mapping of relevant legislation (see Appendix C) that many pieces of noise at source legislation pre-date the END.

It will take **considerable time before all noise at source legislation is strategically aligned with the END**. Typically, EU source directives and regulations are only revised once every 10 – 15 years. Although some pieces of source legislation have been revised, many have not. Specific examples of EU source legislation that has been recently revised and has taken the END into consideration are provided under the "effectiveness" heading, when assessing progress towards the achievement of Art 1(2).

A minority of stakeholders interviewed argued that since source Directives contain Limit Values (LVs) for noise at source, the same principles should apply to noise at receptor. However, many stakeholders were against setting common EU level LVs, since whereas there is a logic to setting LVs for source legislation by transport mode, this cannot be said for noise at receptor, which demands local-specific solutions.

Several stakeholders expressed a strong view that noise is highly localised and tolerance and cultural acceptance of environmental noise varies between EU MS. Overall, there was wide divergence in stakeholder views in both the interviews and at the workshop as to whether common LVs should be introduced at an EU level.

There are however already national LVs in place in almost all EU MS that are determined under subsidiarity. It was emphasised at the workshop that the concept of limit values is treated differently in different EU MS. Whereas in some MS, LVs are treated as legally binding, in other countries, these are non-binding targets or aspirational goals. Further feedback on LVs is provided under Section 3.2.3 (effectiveness) and under future perspectives Section 4.2), where possible ways in which the efficiency, effectiveness and value added of the END could be strengthened in future are considered.

There may also be **efficiency savings resulting from the fact that SNMs and**

[75] See for instance Regulation 540/2014 on the sound level of motor vehicles and of replacement silencing systems, Major railways - Regulation 1304/2014 on the technical specification for interoperability relating to the subsystem rolling stock noise and Regulation (EU) No 598/2014 in respect of noise at airports.

population exposure data estimates are produced through the END. For instance, under the EIA Directive (85/337/EEC)[76], the data and information generated through the END may be useful for meeting the EIA requirements, for instance, in respect of a planned road, railways or airport upgrade or expansion of existing infrastructure, or a specific new transport infrastructure project. There are benefits in having SNM data since this provides a baseline against which the noise impacts of any future development / project that is subject to an EIA can be assessed. However, interviewees were not able to quantify the nature of these costs and benefits, other than that some form of assessment of noise levels would have to be undertaken anyway in the absence of the END as part of the EIA but relating to specific public and private projects.

Whilst having population exposure data by source was useful in not having to start assessing noise levels from scratch, it was also noted by interviewees that in most instances, "bespoke noise monitoring would need to be undertaken for the project". If SNM data cannot be used, because it is not sufficiently detailed to inform EIA work specific to particular projects, then this would limit the scope for cost savings. Noise monitoring within the EIA process is project-specific and would only cover the study area (or potentially only sensitive receptors within the study area). It was furthermore observed that the costs of noise monitoring/mapping for the purposes of EIA are not necessarily borne by the public sector.

They are borne by the project proponent who may be from the public sector, but could just as easily be a private developer. The END and the EIA are therefore largely mutually exclusive, other than the potential to use SNM data to inform the baseline. The END reporting and monitoring system could perhaps in future be upgraded.

EQ3 - Are there any specific legal gaps, overlaps and inconsistencies identified in the END and other EU legislation and between the END and national legislation?

Turning to the **coherence between the END and other EU environmental and spatial legislation which may impact on environmental noise**, most stakeholders did not report there to be any direct or indirect overlap or duplication.

A small minority number of stakeholders raised concerns about the risk of possible areas of overlap and duplication, but the examples these stakeholders provided suggest that their concerns stemmed from the specific way in which different Directives have been implemented at national level in their respective countries rather than suggesting overlaps or inconsistencies at European level.

There is, however, one instance where there may be such an overlap at European level: The industrial noise is covered within the scope of the END and industrial noise control also falls within the scope of the 2010 **Industrial Emissions Directive**[77], formerly the IPPC Directive. The Directive lays down rules on integrated prevention and control of pollution arising from industrial activities (including noise). Given the various stakeholder feedback received on this issue, the following paragraphs provide a more detailed discussion of this potential overlap and its implications.

The IED is based on several pillars, including an integrated approach that takes into account a number of environmental considerations, including noise.

[76] The Environmental Impact Assessment or EIA Directive (85/337/EEC) has been in force since 1985 and applies to a wide range of defined public and private projects http://ec.europa.eu/environment/eia/eia-legalcontext.htm

[77] Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control) http://ec.europa.eu/environment/industry/stationary/ied/legislation.htm

Some stakeholders, especially in the UK but also in a couple of other EU countries argued that industrial noise does not belong in the END at all, since the Directive is primarily about the exposure of citizens to transport noise.

Whilst there are similarities in that the IED requires monitoring of industrial noise emissions (which implies mapping the nature and scale of the problem) as does the END (within agglomerations only), there are also key differences. For instance, the IED contains mandatory requirements on environmental inspections. Generally, stakeholders interviewed did not perceive there to be a problem of overlap. This was confirmed by workshop participants and written responses to the working papers.

This appears to have led to practical difficulties, at least in several countries within one Member State (the UK). For instance, several CAs involved in a group discussion on END implementation in the UK mentioned that there was perceived duplication between the noise mapping requirements under the END and those under the former IPCC (although this EU legislation has now been superseded by the IED). In **Scotland,** the requirements in respect of the former IPPC Directive have been incorporated into national legislation and a decision was taken to map industrial noise under the IPCC requirements rather than through the END. This has meant that as a consequence, industrial noise is not comparable between Rounds since in R1, all industrial noise in agglomerations was mapped whereas in R2, only IPPC-regulated industry was mapped.

Furthermore, a number of stakeholders in the **UK** that took part in a group stakeholder discussion questioned whether it is appropriate to map industrial sources of noise in the same way as for other sources since industrial noise is arguably different from other types of environmental noise. The stakeholders stated that it is not just a question of the dB(A) level but whether the noise is intrusive over the background level. Indeed, it was questioned whether it is appropriate for industrial noise to be covered through the END at all, given that it is already covered within the IED. The national CA for England commented that *"the IED provides a means for preventing excessive industrial noise at source. So this potentially overlaps with provisions in the END requiring MS to develop agglomeration action plans that include industrial noise sources".* This does however appear to depend on how the two Directives have been implemented and transposed into national implementing regulations.

In **Hungary,** on the other hand, (although feedback from some stakeholders suggests otherwise), the national CA did not perceive there to be an overlap between the END and the IED, commenting that *"Whilst noise is part of the definition of "pollution" and "emissions" in the IED, it does not contain any specific provision regarding strategic noise maps. Neither does the Gov. Decree, [which] only defines the cases when noise impact also has to be assessed besides other environmental impacts. The detailed rules for carrying out noise mapping of industrial sites are in the END/Noise decree, so there is no duplication*".

At the stakeholder workshop, most Member States did not view the inclusion of industrial noise within the END as a problem, and did neither believe that it was duplicative due to already being covered under other legislation such as the IED. However, two stakeholders from **Germany** believed that the END should focus on transport noise at receptor alone so as to ensure that the Directive's focus remains on tackling noise from different transport sources at receptor, and to ensure coherent links between the END and the Directives relating to addressing noise at transport-specific source.

A further area where there was a perceived risk of duplication was in the designation of quiet areas in agglomerations and open country under the END and the designation of protected areas under the **Habitats Directive**[78], the **Birds Directive**[79] and **Natura 2000**[80]. In a UK context, this issue was specific to provisions in the END regarding the identification/protection of quiet areas in open country. There are already several other existing policy mechanisms to designate areas of the countryside, both for conservation purposes and to protect it from incongruous development. For example, National Parks, Areas of Outstanding Natural Beauty, Sites of Special Scientific Interest and sites designated under the Habitats Directive already have special consideration in UK planning policies.

Although recognising that the designations made were being made for different reasons, the national CA in England considered it to be unnecessary to designate and protect the same area of land under more than one EU Directive (i.e. the END and the Habitats Directive. However, this concern does not appear to be shared in other EU MS.

It was pointed out at the workshop that END quiet area protection would need to extend beyond the boundaries of any designated area to encompass external noise sources that may adversely affect the protected area. There were differences of opinion as to whether this issue would be addressed by the other protected area designations.

Some feedback was also received about the need to strengthen the END's coherence with the INSPIRE Directive (2007/2/EC) which is concerned with Infrastructure for Spatial Information (SDI) in the EU. The purpose of the INSPIRE Directive is to improve the sharing of spatial information between public authorities and to improve the accessibility of information and data to the public. Schedule 3 of INSPIRE sets out requirements for noise and is concerned with achieving greater uniformity of data. Since INSPIRE was adopted after the END, there is a need to check whether the END is fully coherent with the requirements of INSPIRE to make information publicly accessible.

However, since the END is implemented under full subsidiarity, the lead responsibility of the Member States to ensure that END population exposure data is linked with other spatial datasets should be emphasised.

Interview feedback suggested that because noise is only mentioned briefly in the INSPIRE Directive in Annex 3, it is difficult for stakeholders to understand how INSPIRE should be applied in practice in the field of noise and to interpret what this means in terms of END data collection. Some interviewees pointed to a number of areas of INSPIRE that appear to be relevant to the END, such as the importance of improving accessibility to the public of the datasets produced through the END and linking these to available spatial datasets, and complying with a fully open access data policy. However, it was pointed out by other stakeholders that through the END, noise maps and population exposure data have already been made publicly available and accessible. In any case, it can be reasonably argued that, rather than representing an instance of duplication, the provision in the INSPIRE Directive and the END should be mutually reinforcing.

Moreover, the END Reporting Mechanism (see EQ12 in Section 3.2.4.4) has already been adapted to reflect INSPIRE. For example, the EEA Handbook[81] on the Electronic Noise Data Reporting Mechanism Relevant states that "*elements of the ENDRM have been formatted in a way that meets the requirements of INSPIRE. This includes the use of the ETRS89 geographical referencing system and the use of spatial metadata standards to*

[78] http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm
[79] http://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm
[80] http://ec.europa.eu/environment/nature/natura2000/index_en.htm
[81] EEA Technical report No 9/2012, Electronic Noise Data Reporting Mechanism - A handbook for delivery of data in accordance with Directive 2002/49/EC

accommodate delivery of noise maps, source locations, agglomeration boundaries and action planning areas, including zones delimited as quiet areas. Importantly the reporting formats are designed to meet a minimum achievable standard which takes into account the diversity of approaches to managing spatial data which currently exists across MS".

Furthermore, the Reporting Mechanism also follows the INSPIRE Directive in relation to defining metadata, at least according to the EEA Handbook. *"The specified metadata standards for spatial data are those currently adopted by the EEA and proposed for future use within INSPIRE. They are based around a profile of ISO19115. The EEA standards will be regularly updated and the standards set by the INSPIRE directive will be followed. The standard for non-spatial data has been harmonised with the standard already used by Reportnet. This is based upon the widely used Dublin Core metadata standard".*

Notwithstanding, some stakeholders argued that the full potential of the data is currently being under-utilised since the data is not as yet systematically linked to other spatial datasets. However, other stakeholders argued that this is the responsibility of individual MS rather than the EC. END data has already been made widely available both through open access websites at national level and through EU level monitoring and reporting tools, such as the EEA's Noise Viewer available through the Noise Observation and Information Service for Europe (http://noise.eionet.europa.eu/viewer.html). Examples were also provided as to how public authorities in some countries have already used END data for their own purposes and integrated with other datasets, for instance, in relation to epidemiological studies.

In summary, from an 'external coherence' perspective, **the END is regarded as being broadly coherent with and complementary to** (with the possible exception of the issue of noise from industry) other EU legislation on noise. Although there could be a perceived overlap between the designation of quiet areas under the END and the designation of protected habitat areas, stakeholders do not generally perceive there to be a problem, with the exception of one Member State.

3.2.2.2 The relationship between the END and national noise policies and legislation

EQ4 - How does the Directive relate to national noise policies and legislation? Is it consistent and to what extent does it duplicate existing requirements?

It should be noted that detailed information on how the Member States have implemented the END (both the initial transposition and subsequent implementation) is provided in Section 2 (the implementation review) and in particular in the 28 country reports.

In EU countries where there is a pre-existing legal framework, such as the **UK,** the **Netherlands** and **Germany**, careful implementation has ensured that there were generally no inconsistencies between the implementation of the END and national legislation on environmental noise.

However, ensuring coherence with existing approaches has sometimes complicated END implementation from a practical perspective. For instance:

- In the **Netherlands,** protected areas in open country had already been defined in national legislation. Since the transposition of the END, there has been confusion among stakeholders about the difference and delineation of protected areas as defined in national legislation and quiet areas as defined in the END.
- In **England**, the potential use of END noise maps and action plans as part of the national policy planning and decision making processes remains a complex area, for instance in respect of the planning and development control system.

- **Denmark** and **Sweden** reported difficulties resulting from technical aspects of the changes in prediction methods (due to the introduction of the common assessment method) and an additional cost in future since they intend to implement Commission Directive (EU) 2015/996 but in parallel continue to report using the national method. Whilst this is their choice for national policy making purposes, it creates an inherent tension between EU and national reporting practices.

In EU Member States that did not have a pre-existing national regulatory framework on environmental noise prior to the END, the legislation appears to have been transposed correctly (at least by later on in R1 since some evidence of infringements was identified in the first implementation review but these have all since been resolved).

In **Latvia,** there has been a general effort to simplify environmental noise legislation. Rather than having several individual pieces of legislation, all noise-related legislation, including the national legislation transposing the END, has been combined into a single legal act. However, this then means that nuisance noise, which is outside the scope of the END, is within the same piece of legislation.

In **Lithuania,** as in many other EU MS, there is national legislation on environmental noise which incorporates receptor limit values. However, the fact that the END does not set out common EU-wide limit values was cited as being problematic for policy makers working on environmental noise issues because there is a tendency for domestic policy makers to consult EU legislation for guidance. Without any such receptor LVs, it is difficult to enforce national standards when these are exceeded. This appears to apply more in some new MS that have only had a legal framework to tackle environmental noise since the END was adopted.

In summary, the findings on coherence with national legislation are that:

- The END can be implemented in a way that is broadly coherent and complementary with pre-existing national policies and legislation on noise, but care has to be taken to avoid duplication and potential overlaps with existing national legislation; and

- The END provides evidence to support the development of future noise policies in those MS without extensive pre-existing policies and procedures, but it does not currently provide an alternative to the development of national policies and expenditure measures to manage, mitigate and potentially reduce environmental noise (as it only provides an intermediate step focused on a "common approach").

3.2.2.3 Internal coherence

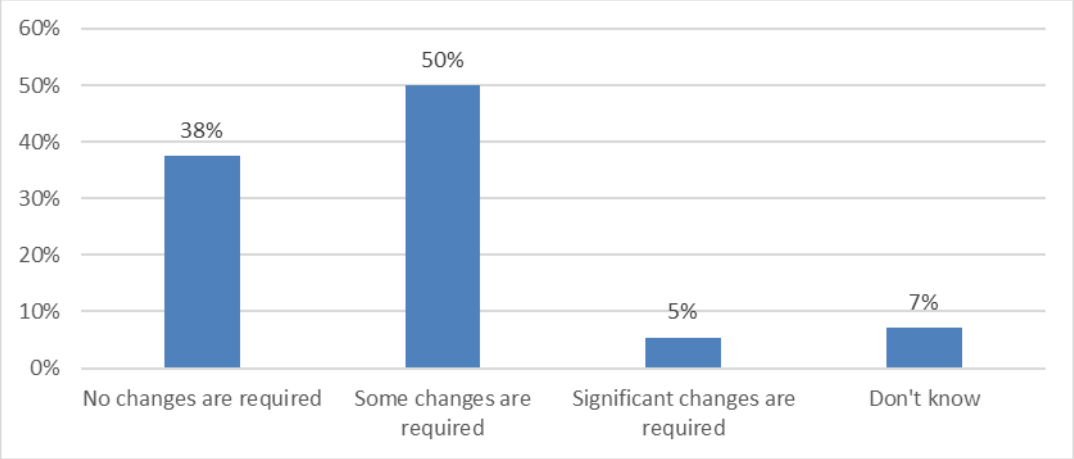
Introduction

The assessment of "internal coherence" required undertaking a detailed review of the Directive's legal text. The purpose was to assess the clarity of the definitions and obligations, and the degree of consistency between different articles / sub-articles. In addressing evaluation questions relating to internal coherence, it is important to emphasise that there are links between the implementation review and the evaluation, since through the implementation review, the outstanding implementation challenges were examined. For instance, Section 2.3.3 addresses the designation of agglomerations, major roads, major railways and major airports) and Section 2.3.5 outlines the difficulties encountered in respect of the "definition, delimitation and protection of quiet areas". Due reference should therefore be made by the reader of this report to these sections, since they provide supplementary information.

The internal consistency and coherence of the END

50% of public authorities responding to the online survey stated that in their view, at least some changes need to be made to the text of the END to strengthen its consistency, whilst another 5% believe that significant changes ought to be made.

Figure 3.4 – Please select one of the following options with regard to your views as to whether there is a need for any changes to be made to the current legislative text of the END (n=56)



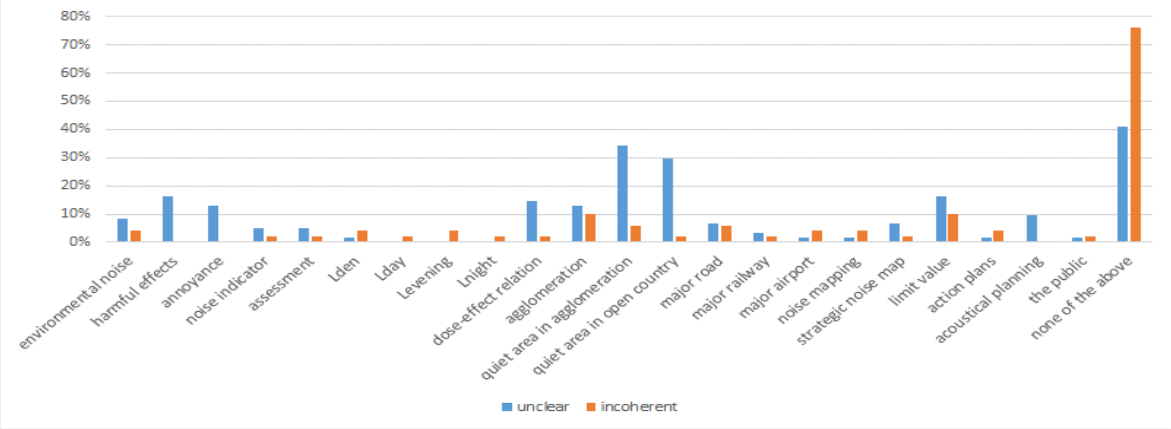
Source – online survey of public authorities

Whilst a small number of inconsistencies could be addressed, more substantive changes could make it more difficult to compare the results from noise mapping and population exposure data between rounds.

EQ5 - Are there any elements of the Directive (e.g. specific articles, definitions of key terms, requirements for public authorities) that are unclear? Are there any provisions that are obsolete and if yes, why?

Stakeholder perceptions as to the clarity of the legal text were examined through the online survey. 76% of respondents believe that none of the definitions in the END are inconsistent with other EU legislation while 40% believe that none of them lack clarity.

Figure 3.5 – Please indicate which of the Directive's definitions lack sufficient clarity (n=61) and which are inconsistent (n=50) with other EU legislation on noise?



Source: online survey of public authorities

The terms whose definitions appear to be causing greater confusion among some END stakeholders are 'quiet areas in agglomerations' mentioned by 35% of respondents, quiet areas in open country (30%), harmful effects (16%) and dose-effect relations (15%) have been cited most frequently as being unclear. The definition of an agglomeration was regarded as being unclear among 12% of respondents whilst 10% found the term inconsistent. Limit values were cited as being unclear by 16% of respondents.

Feedback through the interview programme suggests that whilst the majority of terms and definitions in the legal text of the END do not pose particular problems for END stakeholders, definitional problems and inconsistencies appear to be concentrated in a few areas. The specific definitions terms that have caused problems are now detailed. These draw on interview feedback and desk research. An important literature source was a Working Paper[82] by the Working Group – Assessment of Exposure to Noise (WG-AEN) which identified unclear or missing provisions.

- **Art. 1(1), a Common Approach -** the first objective of the END is to "define a common approach intended to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise".

A possible legal gap is the fact that the Directive does not explicitly describe how MS should prioritise the management of harmful effects. However, several MS have interpreted the words "intended to" and "on a prioritised basis" as being synonymous with the need to define and manage noise "hotspots".

The term "hotspots" is then interpreted differently across different MS, either as relating to those areas where the noise levels are highest, or to areas with the greatest number of exposed persons, or to a high number of exposed persons in the top dB threshold. There is confusion among END stakeholders as to how to go about prioritising noise and whether tackling hotspots is a formal requirement (which it is not since it is not mentioned in the legal text).

- **Art. 2 – Scope.**

Quiet areas - there is no explanation as to what types of 'Quiet Areas ' fall within the scope of the END nor of the criteria to be used to identify and assess what is a quiet area (although the EEA has already produced some very useful guidance in this regard and many MS have developed their own selection criteria). The interview feedback found that defining both quiet areas in open country and quiet areas in agglomerations was one of the areas that appears to cause the greatest problems, even if definitions are provided in Art 3 (l and m).

- **Art. 3 – Definitions.** A number of definitions appear to be causing ongoing interpretation challenges for END stakeholders. The main ones identified are:

Agglomeration (k) – although this term is defined in Art 3, in some EU MS, notably France but also elsewhere, the concept of an agglomeration at national level differs from that set out in the END, which has led to confusion and different interpretations.

Quiet areas in an agglomeration (l) and Quiet areas in open country (m) – since it is left up to the MS to determine the criteria for identifying and designating quiet areas, this appears to have created a lot of ambiguity and scope for differences in interpretation as to what a quiet area is, which means that approximately 30% of stakeholders interviewed said that they found the definition of a quiet area difficult to

[82] Working Paper on Directive 2002/49/EC in relation to the identification of provisions relating to Strategic Noise Maps which are unclear or missing, Working Group – Assessment of Exposure to Noise (WG-AEN).

understand. For instance, for quiet areas in open country, recreational activity is mentioned, but recreational activity is not within the scope of the END under Art. 2.

Major roads (n) - the END states that major roads include regional, national or international road, designated by the Member State, which has more than three million vehicle passages a year. However, regional and international roads lack any kind of definition.

Noise mapping (q) - means the presentation of data on an existing or predicted noise situation in terms of a noise indicator, indicating breaches of *any relevant limit value in force.*

Some stakeholders were confused by this definition since it was pointed out that it remains unclear whether 'Limit Value' refers to the statutory limits where action is obligatory if the limit is exceeded or does this refer to WHO guidance / good practice values or to non-binding targets. This lack of clarity could affect how SNMs showing exceedances are presented.

- **Art. 11(c) - Review and reporting and Annex I – noise indicators** includes references to "measurement" for the purpose of strategic noise mapping,

A number of stakeholders pointed out that using the term "measurement" implies that noise mapping can only be based on actual measurements, whereas in practice, noise assessment is usually based on modelling and prediction using specialist noise software. The term "assessment" would be more neutral. Given the current costs of long term noise monitoring in order to provide an average value over a 12 month period (L_{den}, L_{night}), the current widespread use of modelling and prediction is likely to continue.

- **ANNEX VI – Data to be sent to the EC** which is referred to in Art. 10. "For major roads, major railways and major airports, the total area (in km2) exposed to values of L_{den} higher than 55, 65 and 75 dB respectively".

It was pointed out in a working paper by the working group AEN[83](and at the validation workshop) that it is unclear whether this relates to the 55, 65 and 75 dB contours or contours for values between 55 and 65, 65 and 75 and greater than 75 dB. It was suggested that the standard parameters of 55-59, 60-64, 65-69 and 70-75 dB(A) should instead be used.

EQ6 To what extent is the Directive sufficiently clear in setting out the obligations of Member States at the level of (i) the Competent Authority and (ii) other stakeholders involved in national implementation?

The END is applicable to CAs and other stakeholders involved in national implementation. This includes for instance transport authorities responsible for roads and rail, airport operators and local authorities. A key issue explored through the research was how far the END sets out the obligations of END stakeholders involved in national implementation sufficiently clearly. The role of CAs was also examined, as well as the role of public authorities more widely, since some local authorities are not directly involved in END implementation as competent authorities, but may be asked to provide different types of input data, such as traffic data.

Among the findings from the research were that whilst the flexibility provided by the END is welcomed by most stakeholders, some interviewees noted that this may result in a lack of clarity, since the Directive is not prescriptive in setting out the obligations of different stakeholders in detail.

[83] WG-AEN working paper on missing and unclear provisions

A number of stakeholders commented that there are obligations in the legal text of the Directive that are ambiguous, either because it is not wholly clear whether they really constitute an obligation or because it is unclear how the obligation will be enforced.

One challenge relates to the lack of clarity as to what reporting information and data sub-national public authorities (including CAs responsible for mapping and action planning) must provide to the national CA responsible for collecting data. For instance, it is up to individual MS to provide national guidance on END implementation to ensure that all CAs involved in END implementation (and other public authorities responsible for the provision of input data and END reporting information) are clear about their respective responsibilities.

This means that the END does not place any specific obligations, for instance, on transport authorities, because there is no guarantee when transposing the END that the MS concerned would impose any specific obligations on transport authorities. Overall, this flexibility enables MS to determine the most appropriate implementation arrangements and to set the obligations that different CAs must fulfil in each EU MS.

Whilst this is consistent with subsidiarity, feedback in some MS (such as **Denmark, France** and the **Netherlands**) suggests that the lack of detailed requirements in implementation arrangements can cause difficulties in national implementation, with tensions between different levels of administrative responsibility (national, regional and local).

Examples were provided where local authorities have not complied with requests for information and data from the national CA about progress in carrying out strategic noise mapping and noise action planning or have only provided the requested information very late.

Since the END leaves administrative and reporting arrangements up to each MS, and the requirements of particular public authorities are not stipulated in the Directive, national CAs responsible for data collation sometimes felt that they had no sanction at their disposal to require administrative authorities at national and regional level to provide them with information.

Several interviewees mentioned that they found the text in Art. 7 unclear, in particular that *" strategic noise maps shall be reviewed, and revised <u>if necessary</u>, at least every five years after the date of their preparation".* Whilst it is clear that MS have the discretion to determine whether mapping should be undertaken if for instance there has been no change since five years earlier, stakeholders noted the absence of criteria or a definition to help determine what "if necessary" means in practical terms and to interpret when it should be applied.

Consequently, in theory, one MS may systematically undertake strategic noise mapping once every five years, whereas another may choose not to repeat some aspects of noise mapping, because of a perceived lack of sufficient change over a five year cycle to justify the additional costs, especially for road noise, where acoustics consultants interviewed pointed out that even a doubling of the level of vehicle movements on a road would only lead to an increase in noise levels of 3dB.

In **Latvia,** an example was given where a decision was taken to not repeat noise mapping in R2 since road traffic volumes for most major roads had not changed greatly, and noise levels were likely to be broadly unchanged. Whilst consistent with the concept of only repeating noise mapping if necessary, if replicated across the EU, there is a risk that if some MS decide to carry out noise mapping every five years, but others only do so once every ten years (on the basis that the mapping is not necessary, this could lead to challenges for DG ENV and the EEA in reporting on data completeness in road mapping. It may also lead to confusion among the public and users of noise maps.

In relation to 'quiet areas in open country', as noted in the implementation review, whilst it is clear that action plans in agglomerations should include consideration of quiet areas, this is less clear in respect of quiet areas in open country. The scope for divergence in interpretation was also stressed, since some national CAs stated that in their opinion the designation of quiet areas in open country is not mandatory in the Directive whilst others have interpreted the same text as a mandatory requirement. It was posited by some stakeholders that this could be due to different translations of the END in different languages leading to different interpretations of those sub-articles pertaining to quiet areas in open country.

With regard to **obsolete provisions,** Art. 7 (strategic noise mapping) refers to agglomerations with more than 250,000 inhabitants whereas the definition of an agglomeration refers to the definitive threshold of 100,000 inhabitants, so the reference to the higher threshold after 2005 could be deleted. As noted above, there are various references in the legal text to measurement which should be replaced with 'assessment' which is more neutral. Therefore, the word measurement is also obsolete. In updating the END at some future point, as noted earlier in assessing external coherence, since the legal base (the Nice Treaty) has evolved, and the Lisbon Treaty has come into effect, the term Community Actions and Community measures is obsolete because the correct terminology is now EU Actions and EU measures.

In conclusion, the END is drafted in a way that leaves broad flexibility under subsidiarity in its implementation by making the MS responsible for setting out their implementation arrangements, If however the Directive were to be reviewed in future, some stakeholders would be in favour of an approach that sets out the obligations of the MS in greater detail to improve the clarity of the requirements. Conversely, other national CAs were in favour of maintaining the status quo since this provides them with flexibility to determine national END implementation arrangements.

3.2.3 Effectiveness (and impacts)

3.2.3.1 Progress towards the first objective of the END – a 'common approach'

Overall progress towards a common approach is first examined (EQ7). The specific aspects of a common approach (noise mapping, information accessibility and noise action planning) are each then addressed in detail separately.

EQ7 - What progress has been made towards achieving the first objective of the END?

Introduction

The first objective of the END, as set out in Art. 1(1) is concerned *with 'defining a common approach intended to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise'.* Hereafter, the phrase "a common approach" is used as shorthand for this more detailed objective.

It is important to note that the two objectives of the END are **mutually supporting and reinforcing.** Although many environmental noise issues arise at local level and are specific to each MS, progress towards a "common approach" to the assessment of environmental noise through strategic noise mapping is a crucial step towards harmonising the data and enabling national-level data and information on population exposure by transport source to be collected at EU level. This is an important precursor if END population exposure data is to be utilised by EU policy makers to inform the revision of existing EU noise at source legislation, the second objective of the END.

Evaluation sub-questions addressed within this EQ

This EQ requires a complex assessment of a number of different issues, which have been divided up into different evaluation sub-questions, as follows:

- EQ 7a – What progress has been made in respect of Article 1(1) – strategic noise mapping?
- EQ 7b - What progress has been made in respect of Article 1(1)b - making information on environmental noise and its effects is made available to the public?
- EQ 7c - How much progress has been made towards Article 1(1)c - the adoption of Noise Action Plans by the Member States, based upon noise mapping results?
- EQ 7d - How effective have public consultations been in informing noise action planning processes and in the finalisation of NAPs?
- EQ7e -Has the speed of progress been in line with expectations?
- EQ7f - Has the Directive been adapted to technical and scientific progress? (See Appendix G).

Whilst most of these sub-EQs have been assessed in this section, due to space limitations, more technical issues, such as whether the Directive has been sufficiently well-adapted to technical and scientific progress, are assessed in Appendix G. This Appendix also considers some of the more technical aspects, such as the outstanding challenges to ensuring greater data comparability.

In assessing progress towards the objective of a "common approach", each of the specific actions mentioned in Art. 1(1) a – c needs to be considered, since these are the actions that collectively should have contributed to the achievement of a common approach:

Box 3.1 - Actions required to implement a 'common approach' under Art 1(1)

Art. 1(1a) - the determination of exposure to environmental noise, through noise mapping, by methods of assessment common to the Member States;

Art. 1(1b) - ensuring that information on environmental noise and its effects is made available to the public; and

Art. 1(1c) - the adoption of action plans by the Member States, based upon noise-mapping results.

3.2.3.2 Progress in respect of a common approach - Action 1a, 1b and 1c.

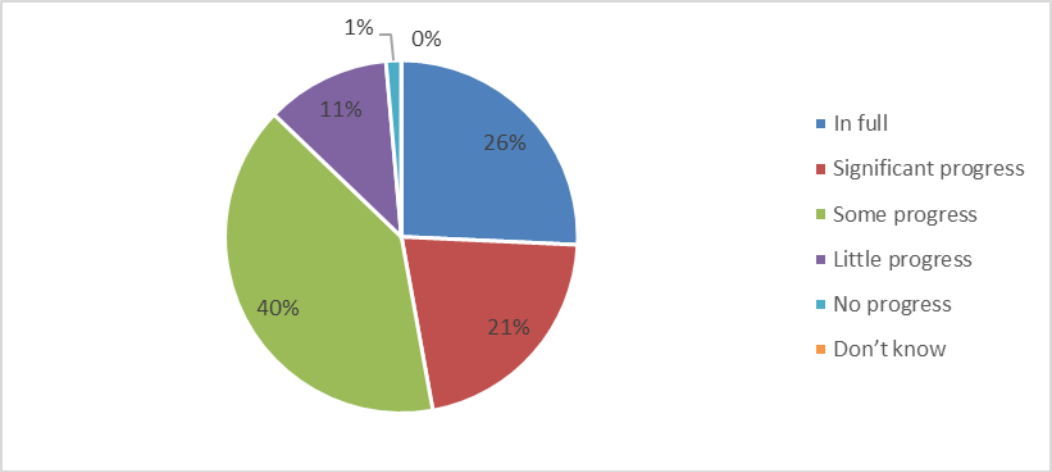
Many stakeholders viewed a common approach as being mainly relevant to strategic noise mapping and the collection of population exposure data (i.e. Action A). However, it is also important to assess the contribution of Actions B and C towards a common approach, even if under subsidiarity, there are differing implementation approaches.

For instance, the fact that all 28 EU MS go through the same process of producing noise action plans based on noise mapping results is an important element of a 'common approach'. Even if NAPs may differ widely in terms of the types of measures identified, whether they adopt a more strategic or operational approach, their length etc. the process of preparing NAPs is common in that all CAs must follow the minimum requirements for NAPs set out in Annex V, undertake a public consultation and make the draft and final NAPs publicly accessible.

The following questions address noise mapping, information availability for the public and noise action planning respectively i.e. relate to Art. 1(1a), 1 (1b) and 1 (1c) of the END.

Online survey respondents were asked for their perceptions as to the extent of progress in respect of the first objective of the END. Among the 70 public authorities that responded to this question in the online survey, 26% thought that the END has already achieved its objective of defining a common approach in full, whilst a further 61% believe that either "significant" or "some progress" has been made. Only 11% believe that little progress has been made (the interview feedback suggested that this was mainly to do with the comparability of noise exposure data).

Figure 3.6 - Assessment of progress towards the first objective of the END: a common approach - Article 1(1) - (n=70)



Source: Online survey of public authorities

It is important to set the online survey results in an appropriate context, since additional feedback was obtained through the interview programme on the extent of progress. Many stakeholders stated that whilst significant progress has been made, a fully common approach, in which comparable data is available, will take considerable time to achieve, since the CNOSSOS-EU methodology, as incorporated in Commission Directive (EU) 2015/996, will not be implemented across EU-28 until R4 in 2022.

EQ 7a – What progress has been made in respect of Article 1(1a)?

The summary findings are first presented, followed by an overview as to how CNOSSOS-EU was developed. A review of the extent to which progress made has taken into account scientific and technical 'state of the art' is then provided. In assessing progress, a distinction was made between the development phase of CNOSSOS-EU (2007-2015) and its future implementation (the pre-implementation phase in 2015-2017 and the implementation of Commission Directive (EU) 2015/996 which replaced Annex II, which will be on a voluntary basis in R3 / 2017 and be mandatory from R4 / 2022 onwards).

Key findings - strategic noise mapping through common assessment methods

The summary findings are that:

- END stakeholders recognised that considerable progress has been made towards the development of a common approach to noise assessment methods through the CNOSSOS-EU process.
- Progress towards the development of a common approach in this area was seen by most stakeholders as a major achievement compared with the baseline situation prior to the adoption of the END, when:
  - Most MS did not use a noise mapping based approach to model and manage environmental noise, and those that did tended to use a variety of different approaches and methodologies.
  - Even in those few MS that already undertook some form of noise mapping, many MS did not collect data on population exposure in 5 dB bands. Rather, a wide range of different assessment methods and noise indicators were used prior to the introduction of the EU-wide L_{den} and L_{night} metrics.
  - Moreover, there was no common assessment methodology at EU level, nor was any population exposure data collected.
- Most stakeholders agreed that the detailed technical approach developed in the 2012 publication on the CNOSSOS-EU methodology by the Commission's DG ENV and the JRC reflects scientific and technical progress and "state of the art" relating to each source.
- It has taken 8 years to develop common noise assessment methods through CNOSSOS-EU and to replace Annex II. This was an ambitious, technical and complex undertaking, and the process has therefore required significant time and resources. There was also a need to secure agreement with EU MS on finalising the technical characteristics of CNOSSOS-EU, which required coordination by the EC.
- It will also take some time before Commission Directive (EU) 2015/996 will be fully implemented, since there is a need to allow MS authorities' sufficient time to adapt to the technical and coordination challenges in moving from an interim to a harmonised EU-wide approach to noise mapping.
- Since the implementation of the CNOSSOS-EU methodology will not be mandatory until R4 (2022), this will limit data comparability between MS and rounds until such time as all MS have implemented a common approach. .
- Once fully implemented, the Commission Directive mentioned above should lead to harmonised and comparable data, although some END stakeholders expressed concerns about the need to further standardise input data to strengthen comparability.

In the following box, a summary overview of the development of the CNOSSOS-EU methodology and adoption of Commission Directive (EU) 2015/996 is provided:

Box 3.2 - Overview of the development of the CNOSSOS-EU methodology and adoption of Commission Directive (EU) 2015/996

The process of developing CNOSSOS-EU commenced in 2007. As required in Annex II of the END, the development of a common methodology for noise assessment was a technical process led by the EC (ENV and the JRC) in co-operation with the EU MS to facilitate the transition to a common method of undertaking strategic noise mapping. The development of CNOSSOS-EU was coordinated by the EC and undertaken in close liaison with the CNOSSOS-EU Technical Committee. Development and implementation has taken place over five phases: (1) a preparatory phase, (2) the establishment of technical working groups, (3) fine-tuning the text, (3) the development of reference codes (4)the pre-launch phase which requires national databases to be developed which are being integrated into the CNOSSOS-EU database and the implementation phase, which will involve the transition between the use of national and interim

methods and the common EU noise assessment method to implementing the new Commission Directive (see below)...

In summary, the specific milestones that have been achieved to date are:

- The publication of the CNOSSOS-EU methodology (2012) setting out common noise assessment methods 84 and subsequent validation by technical experts to ensure that the method takes into account scientific and technical 'state of the art'
- The publication of Commission Directive (EU) 2015/996/EC in May 2015 establishing common noise assessment methods according to the END (replacing Annex II).

In Appendix G, a more detailed evaluative assessment and summary of technical aspects relating to CNOSSOS is provided. In particular, this provides an assessment of the following:

- The development of CNOSSOS-EU - and extent to which the common noise assessment method was adapted to technical and scientific progress;
- Outstanding challenges in implementing Commission Directive (EU) 2015/996; and
- Implementation challenges to ensure that the results of strategic noise mapping produce comparable data.

These are important aspects of the evaluation of the Directive, but since these issues are of a more technical nature, they are presented as an Appendix.

Delays in the submission of reporting data on SNMs and to the EC

In Section 2.3.7 (Strategic Noise Mapping), data from the EC's database on SNMs is presented. This showed that in a number of EU MS, there have been delays in the submission of reporting data and information in both R1 and R2. Whilst this is an important issue explored in detail in the second implementation review, since data not submitted represents an "implementation gap", the lack of a complete reporting dataset across the EU-28 is also relevant when assessing effectiveness, since this will have an impact on the achievement of the second objective of the END (as defined in Art. 1(2) informing the development of Community measures related to source legislation).

A small number of MS have delivered SNMs well after the reporting deadline has passed, such as CZ, EL, FR (especially agglomerations), MT, RO, and SI. Problems in the timely submission of reporting information and data were encountered in both R1 and R2. Possible explanatory factors for delays in reporting submissions were analysed in Section 2 (second implementation review) and are highlighted in the example on the following page:

[84] https://ec.europa.eu/jrc/sites/default/files/cnossos-eu%2520jrc%2520reference%2520report_final_on%2520line%2520version_10%2520august%25202012.pdf

Box 3.3 Delays in the submission of END reporting data and information

Delays in the submission of reporting data related to the END through the ENDRM were attributed to a number of issues, including:

1. The 12 months' timeframe between the submission of SNMs and NAPs. This was widely seen as too short to allow for the different steps involved in action planning to be completed, including public consultations and consultation with colleagues in other policy areas, .
2. In the context of the economic and financial crisis, national and sub-national budgets for noise mapping were often reduced and / or, there were delays in the necessary funding being made available to the relevant public authorities.
3. National CAs in some MS have found it difficult to ensure effective and timely coordination of other CAs nominated as mapping bodies at local level. This was especially the case in MS where a highly decentralised approach has been adopted to implementation (e.g. in FR and DE, there are many hundreds of mapping bodies in total).
4. There was a reluctance among smaller local authorities in some MS to commit funding to noise mapping unless dedicated budget from central government was made available for this purpose. This has led to major delays in the development of SNMs.
5. Some national CAs pointed to a lack of enforcement powers to compel other competent authorities at local and regional level to provide END reporting data on a timely basis. However, since the END is implemented under subsidiarity, it is up to MS to determine their own national implementation arrangements, including organising reporting procedures.

Moreover, comparability issues arise from the fact that data is aggregated at various levels for SNMs and NAP submission, as pointed out in Sections 2.3.7 and 2.3.8 respectively. For instance, it is currently not obligatory for MS to provide data on the number of agglomerations for which SNMs have been submitted. Rather, the EEA measures completeness based on the number of major roads, railways, and aircraft noise sources *within agglomerations* which have been mapped. For NAPs, on the other hand, completeness figures are available for agglomerations *as a whole*.

It was observed by a number of stakeholders interviewed that there is a **lack of an effective EU-level enforcement mechanism relating to tackling the problem of delays in national CAs meeting END reporting deadlines stipulated in the Directive**. Whilst infringement procedures could in theory be launched against particular MS, as demonstrated in Section 3.2.4 on administrative costs within efficiency (see EQ11a), some MS lack adequate human resources for END implementation. Moreover, according to the findings set out in EQ12, the Reporting Mechanism used by most EU MS, Reportnet, requires entering a lot of data and information in different data fields. Moreover, delays in making national budget available (sometimes attributed to the financial and economic crisis) have led to corresponding delays in procuring technical services to carry out noise mapping. In some MS, such as Luxembourg, the need for formal political approval was found to have added additional delays to the submission of reporting data to the EC and its publication and making accessible to the public.

Given the practical difficulties that MS have encountered in meeting the END reporting deadlines, the use of formal infringement proceedings may be too blunt an instrument to compel MS to meet their END reporting obligations on a timely basis.

The current absence of any penalties for delays in the submission of END reporting data may according to some stakeholders interviewed, mean that there is a lack of incentive to deliver reporting deliverables on time, which undermines the effectiveness of the END's implementation and the timely availability of data for EU policy making purposes (Art. 1(1)b) and for EU reporting purposes (Art. 11). Possible means of overcoming the lack of effective enforcement are considered under "prospective issues" in Section 4.3.

The quality of data collected through SNMs

The **quality of END data obtained through SNMs** from the MS through the ENDRM is an important issue relating to effectiveness, since this influences the utility of the data and ability to inform source legislation (Article 1(2)).

Several stakeholders pointed to a **lack of comparability in data between rounds**, for instance, due to changes between R1 and R2 in noise mapping methodology adopted for a particular SNM. This means that the data could be misinterpreted as signifying an increase (or decrease) in population exposure data when it is difficult to assert with certainty that the level of magnitude of change that occurred in the reporting database actually occurred.

In terms of the quality of information in the database of NAPs, even 15 months after the deadline for submission of NAPs, the Eionet database of NAPs only contained information for R2 from about half of MS. The situation has subsequently improved significantly, but well after the original reporting deadline.

The reporting mechanism is a **useful monitoring tool for the EC to identify what data is missing**, both in terms of data completeness (i.e. knowing which MS are behind in implementation and in submitting reporting information to the EC), but also in respect of the content of NAPs. The database contains some fields which are useful for shedding light on the extent to which minimum requirements for NAPs (as defined in Annex V) are being complied with. For instance, the NAP database for R1 shows that only a **small proportion of NAPs overall have provided detailed cost-benefit information about measures** as part of the financial information section of NAPs. Further good practice guidance could be issued to improve the treatment in NAPs of costs and benefits.

A further interesting issue raised was in relation to the **use of data gathered through Reportnet by the EEA and its presentation in official reports**. Since the Lden and Lnight indicators are assessed on the basis of estimates rather than actual noise measurements, some stakeholders were concerned that reporting data is presented as the number of persons actually exposed, whereas in fact, the data represents an estimate of the number of persons *potentially exposed*.

Firstly, estimates of population exposure through strategic noise mapping within the END are measured *outside* buildings, which does not take into account whether any mitigation measures have been implemented such as noise insulation of windows. Secondly, since L_{den} is an indicator based on an *average level of noise* over a 12 month period, the estimates are often based on computer-based modelling rather than on actual estimates.

In terms of the **quality of information in the database of NAPs**, even 15 months after the deadline for submission of NAPs, the EIONET database of NAPs only contained information for R2 from about half of MS. The situation has subsequently improved considerably (based on data available, but this is already well after the original reporting deadline.

Several issues were identified through desk research relating to the **assessment of completeness of data submission** carried out by the study team since it was necessary in carrying out the second implementation review to use the EC databases that contain data reported by the MS. This was supplemented by feedback from those directly involved in the process. Sometimes, completeness by km of major roads and major railways is specified in the metadata file, but this is only checked in case of doubts or problems with the data rather than systematically. In addition, **it is not entirely clear whether data submitted by MS on major roads and major railways refers only to those *within* or *outside* agglomerations, or both.**

The contractor supporting the EEA states that MS (and regions within MS) define agglomerations and major infrastructures differently, and have chosen different interpretations and a different scope for the reporting mechanism. In some cases, this information has been provided in the metadata files, but, again, this has not been checked in detail for all MS/regions reporting information. The relevant handbook for the Electronic Noise Data Reporting Mechanism (ENDRM)[85] does specify that reporting obligations are sub-divided into information required by major roads, major railways, major airports, and agglomerations, and separately for the four main noise sources within agglomerations, but does not clearly spell out whether the former should include major infrastructures within agglomerations, or not.

This means that any **completeness assessment for SNMs of major roads and major railways** remains imprecise and comparability across MS is limited. In order to get a more accurate picture of completeness of submissions, the reporting requirements and the reporting mechanism would have to be changed. Even then, though, there may be challenges for the EC in interpreting the completeness of SNMs since MS report differently on major roads and major railways. Whilst in some MS, such as the **UK**, noise mapping of major roads has covered the entire roads network through a single map, in other MS, such as **Poland,** SNMs have been produced on hundreds of road segments. In other MS, the mapping of major roads may cover multiple road sections. It is therefore difficult to determine at a given point in time, what percentage completeness has been achieved relating to the overall mapping requirements within the scope of the END in a given MS. The situation is similar in respect of major railways. However, the EEA and the contractor that supports the EEA in analysing the data have sought to adapt to the fact that different MS report differently.

Moreover, **submission completeness information for agglomerations is not collected at an aggregate level within each agglomeration** (see also Section 2.3.7) but separately for each of the major noise sources *within* agglomerations (road, railway, aircraft, and industrial noise). An overview of completeness at agglomeration level has been obtained for the country report as part of the implementation review. Indeed, an overview of noise map data for *all sources* in agglomerations on aggregate is foreseen Electronic Noise Data Reporting Mechanism (ENDRM)[86], so it should be feasible to also report on submission completeness at this level.

END stakeholders with strong knowledge of the databases commented that exposure data is **only reported by each transport source *within* agglomerations** i.e. the spreadsheet does not reveal how many people are exposed to noise outside agglomerations as a whole, or how many are exposed within agglomerations to any kind of noise. The only thing that can presently be derived is how people are exposed to road noise within agglomerations.

Checking the completeness of *noise maps and population exposure data* is part of the quality check performed by the EEA. In recent years, there has also been a quality check undertaken of data quality. If any major problems are identified, then the corresponding data is discarded from the assessment developed at an EU level. It would however be **very resource-intensive for either the EEA or the EC to check the quality of noise maps and accuracy of population exposure in detail**, given the many variables that are specific to how each SNM has been produced, and the changes that have taken place between rounds.

[85] Electronic Noise Data Reporting Mechanism A handbook for delivery of data in accordance with Directive 2002/49/EC. P. 10

[86] Electronic Noise Data Reporting Mechanism A handbook for delivery of data in accordance with Directive 2002/49/EC. P. 21

The evaluators note that it would also not be that feasible in practice either, since even within a given MS, there will be SNM-specific issues that influence the data, such as variations in input data, methodology, noise mapping software used and population density changes over time and the economic situation (which can have a significant impact on noise at receptor)87. The EEA could however play a role in checking the quality of population exposure data once Commission Directive (EU) 2015/996 has been implemented once there is greater consistency in terms of how the data is produced.

3.2.3.3 Progress in implementing Action 2 (Article 1(1b))

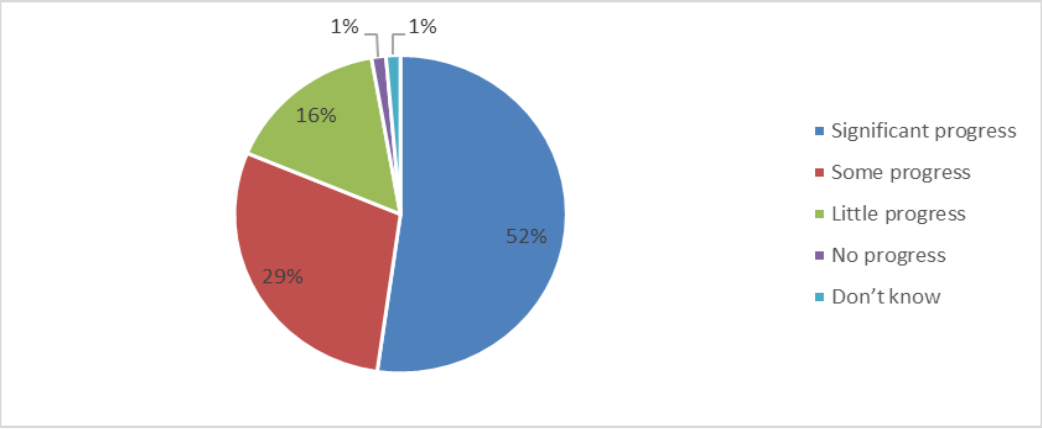
EQ 7b - What progress has been made in respect of Article 1(1b) - making information publicly accessible)

There are different aspects to Action B, "ensuring that information on environmental noise and its effects is made available to the public". This involves, in summary:

1. Publishing Strategic Noise Maps online at MS level;
2. Making population exposure data available at an EU level through the EEA's Noise Viewer;
3. Public consultation during the noise action planning process. Implicitly, Action B is linked to Action C, in that public consultation must take place as part of the preparation of NAPs. The draft NAP must be made available to the public in order that they can comment during the consultation process, and
4. Making final noise action plans publicly available.

Public authorities responding to the online survey were quite positive about progress made in making information publicly accessible in order to inform the public. 52% stated that significant progress has been made and 29% that some progress has been made. It is worth noting however that a significant minority (16%) expressed the view that little progress had been made (quite possibly, the focus in their response was on public consultations rather than making mapping results available, since there appears to be much less of an issue with the latter). The responses are shown in the figure below:

Figure 3.7 – Assessment progress towards making information available (n=69)



Source: Online survey of public authorities

[87] Examples were cited through the research from Scotland and Ireland where the economic crisis and reduction in construction-related road traffic was found to have influenced the level of population exposure by circa 15-20%.

The availability of Strategic Noise Maps and population exposure data

SNMs have generally **been made available online to the public, at least in 27 out of 28 EU countries**. However, during R2, there have been considerable delays in several EU countries in the development, finalisation and submission of R2 noise maps to the EC and EEA. There have been corresponding delays in making R2 SNMs available online in these countries at the same stage in the five year implementation lifecycle. Delays in the provision of accessible information to the public in R2 may undermine the effectiveness of making information available, since to be useful to inform noise action planning, this needs to be made available in a timely manner.

Noise mapping results and population exposure data have also been gathered by the EEA, and **EU-wide data has been made available through the EEA's Noise Viewer[88] tool.** This shows the number of exposed persons at receiver level by transport source. Among the feedback received through interviews on this tool were that it was useful that the data was made available through a single common repository at EU level.

However, as noted earlier, whilst population exposure data by individual transport source is useful for acoustics consultants and policy makers responsible for source legislation, it was not generally perceived by stakeholders interviewed as being that useful from a citizen perspective. This was due to the fact that whilst data on noise exposure by source is **technically useful and policy-relevant**, it is less effective in engaging with the public who do not see noise at receptor as being linked to individual sources but cumulative (i.e. the aggregation of noise from different sources). This issue is explored in greater detail above under the heading of Action A – strategic noise mapping.

The **potential risk of misinterpreting population exposure data** was highlighted in **Ireland**, where this issue has been overcome by producing a set of FAQs to explain the metrics used and to ensure that those using the data understand how L_{den} and L_{night} are calculated. For instance, it is made clear that these are not based on actual measurement at a specific point in time, but based on an average taken over 12 months.

According to a small number of END stakeholders, an issue that potentially undermines the usability and comparability of noise maps is that there remains **divergence in the presentation of colours used in noise maps to depict particular 5 dB(A) incremental bands**, *between* (and even *within*) some EU countries. However, other stakeholders saw this either as a minor issue, or not a significant issue at all.

An analysis of data completeness was provided in Section 2 (the implementation review). The **lack of data completeness undermines monitoring and reporting at EU level** and this may subsequently hinder the development of source legislation, which is partly dependent on EU-wide data being available on population exposure levels in an accessible form. Under Art. 11 - Review and reporting, the EC, supported by the EEA undertake to produce five yearly implementation reviews, to report on medium and long-term goals and on the protection of quiet areas in open country. If reporting information is not forthcoming from the MS, then this will clearly have **knock-on consequences for the utility of reporting information made publicly available at EU level.**

Among the reasons cited by MS for delays in R2 were: a general lack of human and financial resources, the short time span between the deliverance of SNMs and NAPs (12 months), which was viewed in the great majority of MS as being too short to allow sufficient time for public consultation, and to allow for Noise Action Plan revision to take consultation into account prior to finalisation deadlines. The second implementation review found for instance that there appear to be particular problems in respect of data completeness for R2 NAPs for airports and agglomerations.

[88] http://noise.eionet.europa.eu/

Ensuring that a complete set of comparable SNM are available will be increasingly important in future rounds in helping EU policy makers responsible for noise at source legislation to set baselines. Therefore, unless the issue of the timely provision of reporting information (SNMs and NAPs) is improved during the remainder of R2 and subsequent rounds, this may undermine the overall effectiveness of END implementation.

A further aspect of making information publicly accessible is **informing the public about the development of noise action plans during public consultation processes.** This is examined in the next sub-section, which deals with Action C – the process of drawing up NAPs.

The main findings are that:

- The majority of SNMs and NAPs have been made available online. However, in R2, there has been a less systematic effort by CAs in some MS to ensure that maps, exposure data and action plans are made available online in a sufficiently timely manner.
- Several stakeholders suggested that more could be done to strengthen the user-friendliness of noise maps and the presentation of population exposure data. For instance, developing aggregate maps across several sources to show the cumulative impact of noise in a particular area was suggested as one means of strengthening interest in environmental noise issues and improving public engagement.

3.2.3.4 Progress on Action 3 - Article 1(1c)

EQ 7c - How much progress has been made towards Article 1(1c) - the adoption of Noise Action Plans based on noise-mapping results?

Introduction

Art. 8 of the END sets out the detailed requirements in respect of the development of NAPs. CAs have to draw up NAPs based on noise mapping results. NAPs must contain measures to address noise issues and their health effects for major roads, railways, airports and agglomerations. The END requires that the public shall have the opportunity to comment on proposals for action plans and the possibility to participate in the elaboration and reviewing of the action plans.

It is important to stress that a common approach in the context of noise action planning is quite different to that required for strategic noise mapping. Whereas noise mapping under the END is concerned with the technical harmonisation of noise assessment methods, since comparable data is essential to inform source legislation, a common approach to action planning relates only to the procedure of preparing action plans, holding public consultations and identifying noise mitigation, abatement and reduction measures (Art. 8) and respecting the *Minimum Requirements for Action Plans (Annex V).* The content of NAPs and the measures selected are at the discretion of MS CAs.

Key findings – progress in respect of noise action planning

Overall, considerable progress has been made in respect of the development of NAPs over a five year cycle, although as explained in the implementation review (see Section 2.3.8), data completeness information available from the EIONET reporting system shows that there have been problems in several EU MS due to the delayed submission (and in some cases, the lack of the preparation) of NAPs in both R1 and R2.

There is **considerable divergence between MS** with regard to the approach to the development of NAPs, in terms of their content, the types of measures adopted, and the types of financial information on the costs and benefits of the NAP's implementation are provided. The length also varies considerably. Whilst this fully respects subsidiarity, from

an evaluation perspective, this complicates an assessment of what has been achieved since the approaches being adopted to action planning are very different between MS.

The number of NAPs varies significantly between EU MS from one per source (e.g. the **UK / England**) to hundreds of NAPs, in the case of **France,** and even thousands in the case of **Germany,** because action planning is carried out not just at the level of agglomerations, but also by local authorities *within* agglomerations which under the national implementation system must each produce their own NAP. The number of NAPs varies, since according to national federal law in Germany, communities are responsible for action planning, which leads to one NAP per community (in instances where there is a minimum of one source (e.g. major road, major railways of aircraft noise) that exceeds Limit Values defined / suggested by the community itself. An exception is for aircraft noise, since LVs are defined by the German Fluglärmgesetz.

There are also divergent approaches across different MS in terms of how END CAs viewed the purpose of action planning. Some MS saw the purpose of preparing NAPs as being to set out a **strategic approach to noise management**, with detailed aspects of implementation determined later on in other national noise policy or strategy documents. Conversely, in other EU MS, **operational aspects** have been emphasised and greater detail has been provided as to how operational measures will be implemented. Indeed, some NAPs were identified that run into hundreds of pages (e.g. in **RO, ES**).

As described in detail in the implementation review, differences were identified in the approach between EU MS to the development of NAPs in terms of the **types and number of measures** included in NAPs. Examples of differences in approaches to the development and implementation of NAPs are provided in the second implementation review (see Section 2.3.8), which also identifies the most common types of measures mentioned, such as installing noise barriers, land use planning, other technical measures and the use of incentives.

Since differences in implementation approach are a factor that influences the overall effectiveness of noise action planning, a recap is provided below:

- Whereas some MS identify a "long-list" of possible future measures (only some of which are ever likely to go ahead), other MS are only able to mention measures where budget has already been earmarked.
- Some MS put a strong focus on measures that require expenditure for environmental noise mitigation, abatement and reduction, others focus on a combination of measures that expenditure and non-expenditure measures. Other interviewees stated that some NAPs do not include any expenditure measures at all since there is no budget available to address environmental noise at receptor.
- Some local authorities were reluctant to include expenditure measures in NAPs unless there was a firm undertaking from other relevant public authorities and funding bodies to support the measures mentioned, since otherwise they would face pressure from local communities to identify budget for measures.
- Several stakeholders mentioned that although there were many measures identified in R1 NAPs, due to the global economic and financial crisis, expenditure measures were often unlikely to go ahead due to budgetary constraints in R1. This was not expected to change greatly in R2.

The research found that EU MS generally **appreciate the flexibility to develop NAPs that reflect their own vision as to how a NAP should be drawn up**. Moreover, this is in line with subsidiarity principles and because a 'one size fits all' approach would not work, since environmental noise is widely acknowledged as being an issue best addressed locally.

The diversity in approaches to noise action planning, and the absence of reporting information at EU level as to whether measures in NAPs have been implemented, has made it difficult to assess what contribution measures have made, other than through a case study approach. In order to overcome this problem, 19 case studies were carried out to identify examples of NAPs where measures identified in R1 NAPs went ahead and were completed. Reference should be made to the cost-benefit findings set out in the section dealing with efficiency (see Section 3.2.4.5 - Findings from the cost-benefit assessment (EQ13) and the complete case study analysis provided in Appendix F.

Although the cost-benefit work has mainly informed the assessment of the efficiency criterion, at least as a proxy, it has also shed light on some aspects of effectiveness. For instance, in selecting 19 "test cases" at EU level, it was **challenging to identify R1 measures where at least one expenditure measure had been fully implemented across a large number of NAPs in Europe.** This was confirmed through the interview feedback. Although there are measures that have already been implemented through the END in R1 and during the first half of R2, there are equally more NAPs where no expenditure measures have been fully implemented at all and those where measures are beginning to be funded.

This reflects a number of factors, such as budgetary limitations in implementing spending measures due to the impact of the crisis, the long-term nature of the implementation of measures, since budget has to be identified and in some cases, the timescales involved in planning for upgrading transport infrastructure are measured in terms of one – two decades rather than in five yearly cycles. Less positively, some stakeholders were of the view that in some MS, the lack of spending measures was indicative of a lack of sufficient commitment at national level to reducing noise at receptor.

The **wide divergence in approaches to the development of NAPs makes it difficult to assess which expenditure measures identified in NAPs have actually been implemented**. Although Annex V sets out the minimum requirements for inclusion in NAPs and requires MS to include within action plans "provisions envisaged for evaluating the implementation and the results of the action plan", in practice, there is often a lack of information as to what has been implemented and achieved in the previous five years through a NAP.

Although in theory, under the minimum guidelines set out in Annex V, NAPs are meant to include information on "provisions envisaged for evaluating the implementation and the results of the action plan" in their NAP, in practice, **only a small proportion of NAPs appear to currently include a clear update on what were the main achievements during the previous five yearly implementation round.**

Since there is no monitoring data as to which measures have been implemented and their actual as opposed to projected costs in the previous round, it would consequently be difficult to assess the impact of the implementation of individual measures within NAPs without a case study approach. This suggests that monitoring of NAP (and in particular measure implementation) needs to be strengthened in future rounds, an issue explored under 'prospective issues'.

Overall, stakeholders were positive about the benefits of an action planning approach, which included:

- **A more strategic approach to noise management** – in MS that had pre-existing national legislation on environmental noise, it was observed that the END had made them address noise at receptor more strategically, due to the need to prioritise resources to address noise.
- **Greater prioritisation of resources on noise abatement and reduction** - for instance through approaches that have defined noise "hotspots". Whilst a "hotspot"

approach is not compulsory, MS commonly have limited resources to tackle environmental noise. They often therefore prefer to target measures at those areas where noise exposure is greatest or the highest number of people are affected as part of a process of prioritisation based on noise mapping results.

Challenges in ensuring that NAPs are submitted on time

Whilst the evaluators understand that the EC was able to take a more robust approach in relation to ensuring transposition wherever MS had incorrectly transposed the END during the early stages of implementation, there is a lack of a suitable instrument, such as imposing small financial penalties to help enforce the END's requirements in relating to reporting requirements in respect of SNMs and NAPs. The research findings suggest that there has been **weak enforcement of the requirements in the END in relation to the timely submission of NAPs.** Whilst in theory, infringement proceedings are an instrument available to the Commission if reporting delays take place, in practice, the EC appears to have been reluctant to take this course of action. Indeed, given the budgetary pressures faced by many of those working in the environmental noise field at national level, it might be argued that infringement proceedings for transmitting reporting information late would be too blunt an instrument. There is however a lack of alternative sanctions available at EU level to ensure that MS comply with their reporting obligations under Art. 10.

A further observation was made during the interview programme by external stakeholders that unlike for SNMs where there is more dedicated resource, there currently appears to be a **lack of available resources at EU level to monitor and check the quality of NAPs.** It was not possible to obtain the EC or EEA's views on whether resourcing levels are sufficient however, since the EC did not want to risk influencing or biasing the external evaluation of the ENDRM.

Examples were provided of NAPs that do not fully comply with the minimum requirements set out in Annex V of the END. However, the evaluation team noted in reviewing the legal text of the END that no penalties are applicable if MS do not fully comply with Annex V. This means that whilst overall, many NAPs appear to be of adequate quality, given differences in approach, there are wide differences in the content of NAPs. It was also noted by the evaluators in seeking to identify suitable case studies where measures had been fully implemented in R1 that the EIONET database of NAPs suggests that most NAPs do not include cost-benefit information about proposed measures under the financial information section. The desk research found that where such estimates are included, they often relate to the costs, rather than the benefits. This suggests a need for further guidance as to how to assess the costs and benefits. This was reiterated by END stakeholders through the interview programme.

3.2.3.5 Public consultations

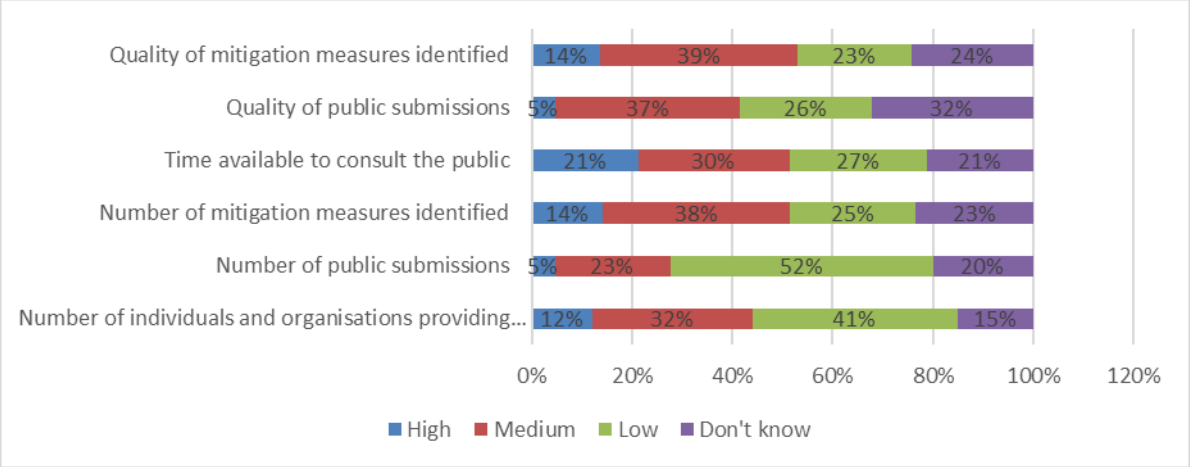
EQ 7d - How effective have public consultations been in informing noise action planning processes and in the finalisation of NAPs?

Under Art. 8 of the END, public consultations are required as part of action planning processes. Art. 8(7) states that "*Member States shall ensure that the public is consulted about proposals for action plans, given early and effective opportunities to participate in the preparation and review of the action plans, that the results of that participation are taken into account and that the public is informed on the decisions taken. Reasonable time-frames shall be provided allowing sufficient time for each stage of public participation".*

Respondents to the online survey for public authorities were asked how they would rate the Directive's impact so far on different aspects of the public involvement in the development of NAPs, including views on the number of individuals and organisations providing input, whether consultation had increased the number of mitigation measures

identified and strengthened the quality of mitigation measures put forward in NAPs, and whether sufficient time was available for the consultation process. The results are set out in the following Figure:

Figure 3.8 – How would you rate each of the following aspects? (n=65)



Source: Online survey of public authorities

The survey responses suggest that public consultation can have a positive impact on strengthening the quality of mitigation measures identified. The quality of submissions from the public appears to vary significantly *between* and *within* EU MS since 37% assessed the quality as high (and 5% very high), but 26% of respondents stated that in their view, the quality of submissions was low.

Less positively, a problem identified in some MS, regions and localities was the lack of interest in public consultation processes relating to noise action planning under the END. In the online survey, in relation to the total number of submissions received, 52% stated that the number was low. However, 23% stated that the number received was medium and only 5% high. In terms of the number of individuals and organisations providing input, which extends beyond providing a written response alone, and may include, for instance, taking part in public meetings relating to the draft NAP, or in a consultation committee, the position was somewhat better with 12% of respondents noting a high level of contribution, 32% a medium contribution. However, 41% of respondents attested to a low level of contribution.

These findings were confirmed through the interviews, which found that although in some countries, there was an adequate level of interest in public consultations, there was often a lack of public engagement. However, in some EU Member States, there has been very active engagement by the public/ interested stakeholder organisations in responding to consultations. Nevertheless, some examples were identified of instances where a very significant number of consultation responses were received. For instance, in Germany, for the Berlin agglomeration, NGOs were very active in promoting participation in public consultations on NAPs.

Box 3.4 Example of active participation in consultation from Germany

According to an NGO taking part in the stakeholder workshop on the evaluation in September 2016, more than 3000 individual responses were received to a consultation on the NAP in R2, the majority from individual citizens.

In R1, through the public consultation, 417 responses were received from individual citizens, public sector bodies and institutions and other organisations. The published NAP includes a chapter explaining how the public consultation was carried out and explaining the process, and then sets out the results from the public consultation[89].

The consultants found that the goals and objectives set out in the NAP were generally accepted by stakeholders. Whilst 106 agencies and organisations deal especially with the recommendations for measures, the private statements mostly point out the local situation experienced and demand further going measures. The consultants evaluated the responses by theme. The following were identified:

- Demand for further T-30 road sections in the major traffic net, especially at night
- More traffic controls by the police to reduce malpractice leading to high noise exposure, for instance, speeding and also driving with manipulated exhaust systems
- Better, less noisy traffic management, for instance, with a better coordination of traffic lights
- Noise protection measures in the urban expressways, for instance with low noise asphalt and noise barriers
- Less noisy vehicles, especially buses and lorries
- Measures to reduce noise from railways, especially on the freight rail stretches
- Measures to reduce aircraft noise.

The results were reported back to some of the institutions and organisations that participated at the 6th Forum for Noise Reduction Planning held in October 2008. However, the consultants also point out that a significant percentage of the objections raised in response to the public consultation were against the extension of Schönefeld Airport, which is a separate issue from a NAP and subject to its separate planning application procedures.

In the view of the evaluators, the above example can be regarded as a good practice since there was (i) an active effort to promote participation (ii) a large number of responses were received which demonstrates engagement and (3) the consultants assisting the CA have provided a clear explanation of the role of the consultation in informing the NAP's finalisation (4) a distinction was made between analysing individual and organisational responses and (5) the scope of public consultation in relation to NAPs was made explicitly clear i.e. to identify suitable mitigation measures and confirm the broad objectives are appropriate.

Source: feedback at workshop from NGO and R1 published NAP.

It is also important to note the findings from the online survey in respect of the amount of time available to carry out public consultations within the context of action planning processes. There was a relatively even split between those END stakeholders that thought that there was a lot of time to carry out public consultations (21%), sufficient time (30%) and insufficient time (27%). This finding was corroborated through the interview programme and the discussions held at the workshop, where stakeholders stated that the timeframe between the finalisation of SNMs and of NAPs (12 months) is too short. Detailed feedback on this issue is provided in the second implementation review (see Section 2.3.8 on NAPs and the five yearly END cycle).

Among the main findings in respect of public consultations that emerged through a combination of the online survey (as per the above figure) and the interviews were that:

- There was a general problem with the **lack of interest in public consultation,** particularly during R2, where there was evidence of less interest compared with the previous round, casting doubt as to the effectiveness of consultations within action planning processes, at least in some EU MS.

[89] http://www.stadtentwicklung.berlin.de/umwelt/laerm/laermminderungsplanung/download/laermaktionsplan/noise-reductionplan_berlin.pdf

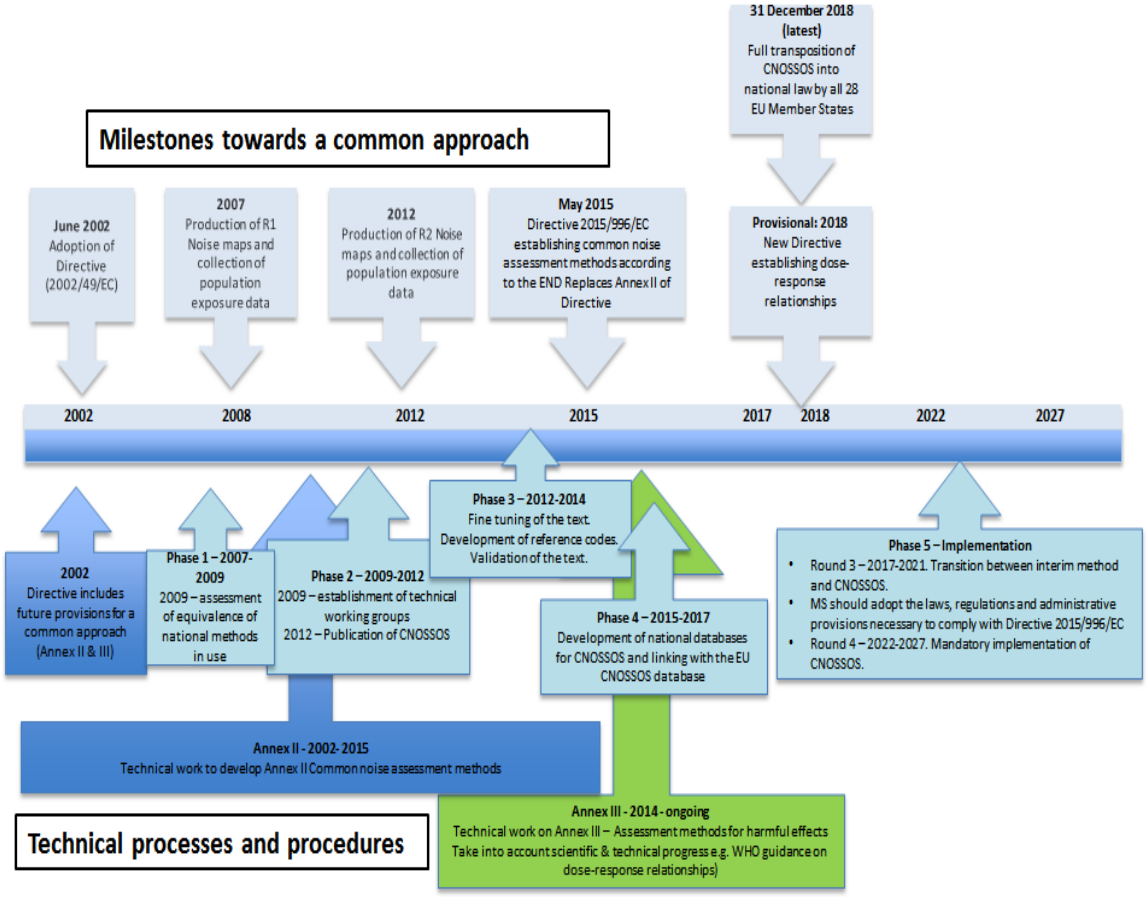
- Some CAs – especially at the local municipal level - expressed frustration that despite their efforts to actively promote public participation in public meetings and events, it had been **difficult to persuade the public to take part in public consultations on NAPs** even where events had been widely publicised in advance of the open meetings.
- According to some NGOs and community organisations interviewed, a further problem was that consultation feedback that they had provided in R1 NAP development had seemingly **not been taken into account**, **making them less likely to participate in R2 consultation processes**.
- There were consequently concerns among NGOs and local community organisations interested in environmental noise as to the overall effectiveness of public consultation. However, some CAs also recalled that sometimes suggestions from NGOs and the public are considered, but it is not always possible to implement suggestions. There is in particular often a lack of budget.
- The time allocated for the public to respond was found to typically **vary between four and twelve weeks**. However, a small number of examples of bad practice were identified where NGOs taking part in noise consultation committees had been asked to comment on NAPs at very short notice. This did not leave them sufficient time to submit a quality response to inform NAP finalisation.
- It was seen as important by CAs and NGOs and local community groups to allocate sufficient time for holding consultations. Since many individuals participate in such activities on a voluntary basis, it takes time for them to form a constructive, collective response.
- Some CAs made it clear that **the number and quality of submissions** received in response to public consultations were **often not rated very highly.** This may partly explain the practical difficulties that CAs may face in demonstrating how they have taken consultation feedback on board. However, receiving a low number of consultation responses was not the case in all EU MS. For instance, Germany, reported a strong response rate to END public consultations.
- The contributions made by stronger NGOs and community groups with the **necessary technical capacity** much more useful to action planning authorities than contributions from individual citizens, which were often either of low quality or difficult to integrate into NAPs. This suggests that **targeted consultations can be more effective** than aiming for a large consultation response, where the quality and utility of submissions is much more uncertain.
- A number of END stakeholders stated that consultation within the END would be more effective if CAs viewed consultation with local communities as an **ongoing exercise rather than a one-off consultation** during the period prior to NAP finalisation. Some airports operators have adopted this approach under the END, and stated that it had been effective in building community engagement.
- The results of public consultations relating to draft NAPs have generally been **made available to the public by publishing them online** and / or by incorporating consultation responses directly into draft action plans.
- However, the emphasis has tended to be on ensuring that **summaries of consultation feedback** were published, rather than making information available on how consultation feedback had been taken into account in the finalisation of NAPs.

EQ7e -Has the speed of progress been in line with expectations?

Achieving a common approach will require **a long-term commitment** on the part of the EC in their coordination role, working in conjunction with international partners, notably the WHO, which is developing common methods for assessing the harmful effects of noise by establishing revised source-specific dose response relationships.

It will also require long-term commitment by the EU MS who are required to make the transition from national and interim methods to common assessment methods under CNOSSOS[90] by R4. In the following diagram, an overview of the estimated timeline and the trajectory towards a 'common approach' is provided in the following diagram.

Figure 3.9 - Trajectory towards a 'common approach'



Source: Interpretation by CSES and ACCON of current estimated timescales

The purpose of the above diagram is to demonstrate the **long-term nature of realising a 'common approach' in respect of noise assessment methods (Annex II) and dose response relationships (Annex III).** The milestones towards a common approach are set out in the upper part of the diagram whilst the technical processes and procedures involved are outlined in the lower part. It should be emphasised however that **the Directive does not stipulate any timescales by which particular steps towards a common approach have to be developed and implemented**. Whilst some timings outlined in the diagram above are based on the actual timeline (e.g. the preparatory stages of CNOSSOS-EU and the publication of the revised Annex II), the timeline for Annex III (to assess the harmful effects of noise) is only an estimate.

The diagram shows that replacing Annex II with common assessment methods through CNOSSOS-EU was a process that has already taken 8 years of continuous work leading up to the adoption of Commission Directive (EU) 2015/996/EC (establishing common noise assessment methods according to the END). Implementing the revised Commission Directive that replaces Annex II will take several years, since there is first a need to develop national databases and then to link these to the CNOSSOS-EU database. Even though there is no formal timetable in the Directive, several preliminary

[90] The methodology for Common Noise Assessment Methods in Europe that was developed by the European Commission, supported by technical experts between 2009 and 2015.

observations can be made in respect of the timeline towards a 'common approach', drawing on the interview feedback and on discussions with the EC.

Timeline for the revision of Annex II (common assessment methods)

- CNOSSOS-EU will be implemented on a voluntary basis by some MS in R3, but will only be mandatory in R4. This will mean that fully comparable data across the EU to inform EU source legislation will not be available until 2022 (R4). Fully comparable data between rounds will therefore not be available until 2027 (when R5 population exposure can be compared with R4).
- The development of CNOSSOS_EU – and its subsequent implementation – has taken longer compared with the expectations of some stakeholders interviewed.
- However, this reflects the complex and technical nature of the steps needed to replace Annex II, the requirement to take into account technical and scientific 'state of the art' and the need to allow sufficient time for MS to make the transition from using national and interim methods to producing population exposure data using a common method.
- Although some MS would have preferred to have gone ahead and implemented CNOSSOS-EU earlier (i.e. in R3), others wanted to delay its full implementation, so as to allow them sufficient time to adapt national and / or interim methods to noise mapping and to allow for testing before full implementation.

Timeline for the revision of Annex III (Assessment methods for harmful effects)

- Annex III of the Directive requires Member States to assess the health effects of environmental noise in combination with noise exposure data. However, to date and presently, MS are able to use whichever method they wanted.
- Work is ongoing at an EU level to revise Annex III of the END to facilitate the assessment of dose response relationships. This work already commenced in 2014, and some progress has already been made in strengthening common assessment methods for assessing the health effects of environmental noise.
- However, a Directive establishing dose-response relationships to support the END (to replace the current Annex III) is expected to be ready in approximately 2018. This is a provisional estimated timeframe, since no formal timeframe defined in the END itself. This estimate takes into account the delay in the finalisation and publication of the WHO guidelines to assess the health effects of noise of 18 months compared with the original timetable. Although the development of Annex III to assess health effects may be available prior to R3 implementation, it may not be available in sufficient time, but will in any case subsequently allow for the assessment of health effects in R4 and beyond.
- From such time as when the new Annex III will be adopted, MS may use the new methods.
- Once data on population exposure is available (i.e. data from noise maps and data on exposure after an intervention), calculating the health effects is expected to be relatively straight forward by the EC, since it can be produced in an Excel sheet.

EQ7f - Has the Directive been adapted to technical and scientific progress?

The issue as to how far particular aspects of END implementation, notably the development of common noise assessment methods through CNOSSOS-EU have been well-adapted so as to reflect technical and scientific progress is an important question. However, since the issues involved are of a detailed and technical nature, the research findings are set out in Appendix G. Related issues, such as outstanding challenges in strengthening the comparability of data are also considered.

3.2.3.6 *Progress in achieving the END's second objective*

EQ8 - What progress has been made towards achieving the END's second objective?

Introduction

- The second objective of the END – **as set out in Article 1(2) - Providing a basis for developing Community measures to reduce noise emitted by the major sources**– relates in particular to road and rail vehicles and infrastructure, aircraft, outdoor and industrial equipment and mobile machinery (c.f. Art. 1(2). This was recognised by many stakeholders interviewed as being complementary to the first objective, since **measures at receptor alone cannot solve Europe's environmental noise problem**.

The complex interplay between the achievement of the END's first and second objectives was emphasised since the process of measuring the scale of the problem through noise mapping to capture population exposure data and changes over time noise is a crucial pre-requisite before noise at source legislation can be reviewed and strengthened. This explains why noise maps are produced by individual transport source so that EU policy makers can assess the net benefit of requirements set out in transport-specific source legislation.

In assessing the degree of influence of the END on noise at source legislation, a distinction is needed between the influence of the END on the revision of **existing EU noise at source legislation** and the extent to which the END has informed the development of **new source legislation.**

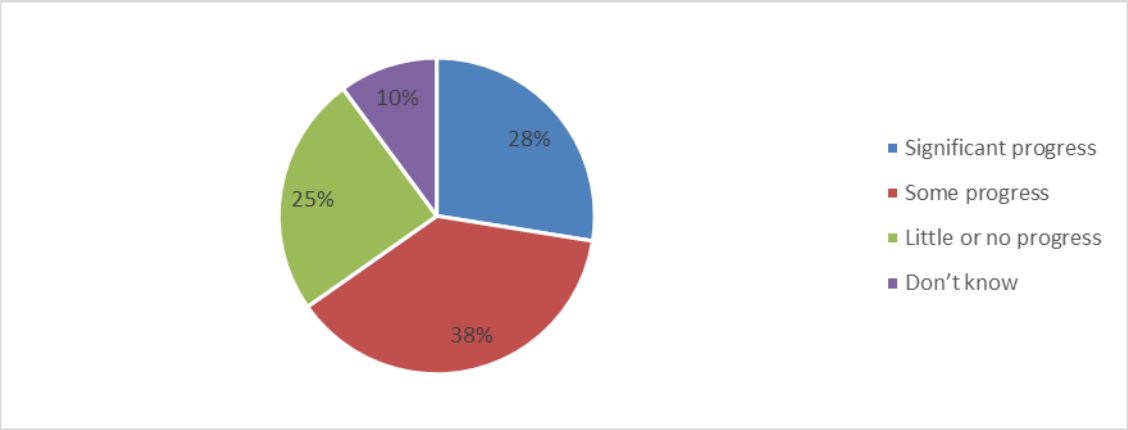
Analysing the impact of the END on source legislation also requires an understanding of EU legislative-making processes and the timescales for the revision of such legislation. Since **source legislation is typically only revised once every 10-15 years**, it will therefore take considerable time before the END influences all source legislation. There was already a substantial body of EU legislation in place prior to the adoption of the END. For instance, there has been legislation on noise at source in motor vehicles since 1970 (Directive 70/157/EEC). EU legislation has been in place in respect of aircraft noise since the early 1990s (Directive 92/14/EEC), based on ICAO standards, although this has recently been updated. Whereas some EU source legislation has not yet been updated since the END was adopted in 2002, other pieces of source legislation have been updated relatively recently, with evidence of strong influence of the END.

In order to assess the extent to which the END has informed source legislation, an extensive mapping of relevant EU legislation was undertaken (see Appendix C). Selected examples of pieces of source legislation that have been revised more recently, and where the END has influenced the legislative formulation process are outlined later in this sub-section.

Key findings - progress towards achieving the END's second objective

Through the online survey, respondents' views were solicited as to the extent of progress towards the second objective of the END. Most stakeholders had a positive opinion about progress. A combined total of 66% thought that either 'some progress' or 'significant progress' had been made, although 25% stated that little or no progress has been made.

Figure 3.10 – Progress towards END objective 2: providing a basis for developing Community measures to reduce noise emitted by major sources (n=69)



Source: Online survey of public authorities

However, caution is needed in interpreting the results, since most END stakeholders are not familiar with the detailed mechanics of EU policy-making processes that inform the revision of EU source legislation. Therefore, in order to assess progress in informing source legislation, interviews were carried out with different Directorate Generals (e.g. DG GROW and MOVE) responsible for noise at source legislation across different transport modes. In addition, the 2004 report to identify existing source legislation was reviewed, since this addressed the requirement in Art. 10(1) for the EC to review existing source legislation and to identify new legislation if necessary (see Appendix C).

Whilst some END stakeholders stated that population exposure data was already 'good enough' to be used by EU policy makers responsible for source legislation, others were concerned that the data is not comparable since the EU is still in the process of harmonising noise at receiver data until CNOSSOS-EU is fully implemented.

Through the evaluation research, the extent to which the END has already influenced and informed source legislation was assessed. A number of positive examples were identified as to how data collected through the END has influenced EU policy makers in the revision of recent source legislation, although there remain concerns about data quality, completeness and comparability among source policy makers.

Through the interview programme, EU policy makers from different responsible EC Directorate Generals (e.g. DG MOVE, DG GROW) mentioned a number of positive aspects to the END:

- The Directive provides an important strategic reference point for EU policy makers responsible for EU source legislation.
- References have been made in the recitals of revised source legislation and in impact assessments to the END's relevance in tackling environmental noise at receptor to complement source legislation.
- The emphasis in the recitals of the END on promoting high levels of protection of human health (a key EU policy objective stemming from the EC Treaty base) and on the potential adverse health effects of high levels of environmental noise has been referred to in the recitals of revised source legislation.
- The emphasis on assessing the extent of environmental noise at receptor through five yearly collection of changes in population exposure data and in measuring the health effects was seen as providing essential information to source policy makers to

assess the (net) benefits of existing source legislation, which is an essential starting point before more stringent limits could be considered.

Source-specific examples as to how the END has influenced the recent revision of different source legislation are now provided grouped by transport source. The focus is on the legislation affecting the automotive and railway sectors, as well as on aircraft noise, since these have been updated in the past two-three years, and the END has been in a position to influence EU legislative revision processes:

Table 3.2 – EU legislation tackling noise at source – selected examples of the influence of the END

Transport type and name of legislation	Description	References to END and other relevant references
Automotive Regulation 540/2014 on the sound level of motor vehicles and of replacement silencing systems, and amending Directive 2007/46/EC and repealing Directive 70/157/EEC	The Regulation aims to improve environmental protection public safety, and quality of life by reducing major sources of noise caused by motor vehicles. It sets out the administrative and technical requirements for the EU approval of all new vehicles of certain categories with regard to their sound level and for the EU approval of replacement silencing systems and related components. The regulation sets noise-limit values for the different vehicle categories and a timeframe for implementation.	Recital 1 refers to providing for a high level of environmental protection and to a better quality of life and health. Recital 3 states that traffic noise harms health in numerous ways. "The effects of traffic noise should be further researched in the same manner as provided for in Directive 2002/49/EC". Recital 13 points out that "noise is a multifaceted issue with multiple sources and factors that influence the sound perceived by people and the impact of sound upon them. Vehicle sound levels are partially dependent on the environment in which the vehicles are used, in particular the quality of the road infrastructure, and therefore a more integrated approach is required. **Directive 2002/49/EC requires SNMs to be drawn up periodically** as regards, inter alia, major roads. **The information presented in maps could form the basis of future research work regarding environmental noise in general, and road surface noise in particular, as well as best practice guides on technological road quality development and a classification of road surface types, if appropriate.** Recital 21 - Vehicle sound levels have a direct impact on the quality of life of Union citizens, in particular in urban areas in which there is little or no electric or underground public transport provision or cycling or walking infrastructure. Also references the objective in the 6th EAP of **substantially reducing the number of people regularly affected by long-term average levels of noise, particularly from traffic.**
Automotive The European Tyre Labelling Regulation (EC/1222/2009)	The Regulation introduced labelling requirements for tyres. The external rolling noise of tyres is one of three types of information that must be displayed.	Recital 8 - states that traffic noise is a significant nuisance and has a harmful effect on health. Regulation (EC) No 661/2009 sets out minimum requirements for the external rolling noise of tyres. Technological developments make it possible to significantly reduce external rolling noise beyond those minimum requirements. To reduce traffic noise, it is therefore appropriate to lay down provisions to

Transport type and name of legislation	Description	References to END and other relevant references
		encourage end-users to purchase tyres with low external rolling noise by providing harmonised information on that parameter". Recital 9 - the provision of harmonised information on external rolling noise would also facilitate the implementation of measures against traffic noise and contribute to increased awareness of the effect of tyres on traffic noise **within the framework of Directive 2002/49/EC relating to the assessment and management of environmental noise.** Art 1. – The aim is *inter alia* to promote low noise levels in tyres.
Major railways Regulation 1304/2014 on the technical specification for interoperability relating to the subsystem rolling stock noise amending Decision 2008/232/EC and repealing Decision 2011/229/EU2	Sets technical specifications for interoperability of rolling stock of the trans-European conventional rail system, including requirements relating to noise emission limits.	Recital 6 - an analysis should be made with a view to reducing noise emitted by existing vehicles while taking into account the competitiveness of the rail sector. It concerns especially freight wagons and is important in order to increase acceptance of rail freight traffic among the citizens.
Major railways Regulation (EU) 2015/429 setting out the modalities to be followed for the application of the charging for the cost of noise effects of freight rolling stock	Sets out the modalities to be followed for the charging of cost of noise effects caused by freight rolling stock whereas charges are commensurate with noise levels.	The White Paper 'Roadmap to a Single European Transport Area — Towards a competitive and resource efficient transport system' (2) indicated that 10 % of the EU's population is exposed to significant noise pollution from rail transport, in particular freight. Noise is a localised externality, affecting people living close to railway lines. Its reduction is the most cost-effective at the source, where the noise is produced. The replacement of cast iron brake blocks with composite brake blocks can bring noise reductions of up to 10 dB. Therefore the support of the retrofitting of wagons with the most economically viable low-noise braking technology available should be encouraged and pursued.
Airports Regulation (EU) No 598/2014 of the European Parliament and of the Council of 16 April 2014 repealing Directive 2002/30/EC	The establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Union airports within a Balanced Approach	Some similarities with the END in terms of the Directive's scope. Like the END, the Regulation only applies to Member States in which an airport with more than 50000 civil aircraft movements per calendar year is located. The END is also referenced in the recitals. Recital 9 - "While noise assessments should be carried out on a regular basis in accordance with Directive 2002/49/EC, such assessments should only lead to additional noise abatement measures if the current combination of noise mitigating measures does not achieve the noise abatement objectives, taking into account expected

Transport type and name of legislation	Description	References to END and other relevant references
		airport development. For airports where a noise problem has been identified, additional noise abatement measures should be identified in accordance with the Balanced Approach methodology. Noise-related operating restrictions should be introduced only when other Balanced Approach measures are not sufficient to attain the specific noise abatement objectives". Recital 11 – "the importance of health aspects needs to be recognised in relation to noise problems, and it is therefore important that those aspects be taken into consideration in a consistent manner at all airports when a decision is taken on noise abatement objectives, taking into account the existence of common Union rules in this area. Therefore, health aspects should be assessed in accordance with Union legislation on the evaluation of noise effects". Recital 12 – Noise assessments should be based on objective and measurable criteria common to all Member States and should build on existing information available, such as information arising from the implementation of Directive 2002/49/EC. EU MS should ensure that such information is reliable, that it is obtained in a transparent manner and that it is accessible to CAs and stakeholders. CAs should put in place the necessary monitoring tools.

The extensive references to the END in recently revised source legislation outlined in the above table show that the END has already had an impact on influencing the development of policy thinking across different transport modes, for instance, the references to the health effects of environmental noise and to the possible future use of END data to inform mitigation and abatement measures.

The extent of influence of the END on existing source legislation was also found to be dependent as to whether source legislation has recently been revised and updated. Legislation is commonly updated only once every 10-15 years so it will take time for the complete body of EU source legislation to go through legislative revision processes.

A contrast can be drawn between the **policy rationales cited for source legislation for different transport sources**. In the case of the automotive and aviation sectors, **the recitals to** source legislation mention the need to ensure high levels of protection of human health and mention the need to minimise the adverse effects to human health of high levels of environmental noise. Conversely, in the case of railways, because TSIs (Technical Specifications for Interoperability) are standards primarily concerned with technical harmonisation within the internal market, the policy rationale is centred on **strengthening the rail sector's competitiveness** and on **ensuring a level playing field within the internal market**.

However, some stakeholders interviewed noted that whilst the **need to protect human health is mentioned in the recitals**, the revision of the legislation, in particular the development of limit values for aircraft noise, road vehicle and tyre noise limits appear to have **mainly been driven by discussions with industry, rather than being primarily influenced by health protection considerations.** This was somewhat difficult to assess through the evaluation.

Feedback from the interview programme as to how far the END has influenced source legislation, and the extent to which this might be enhanced in future, once fully comparable data is available is available, is now examined.

In the **railway sector**[91], EU policymakers stated that the existence of the END and an emerging evidence base through noise mapping and population exposure data had played a positive role in strengthening attention to noise mitigation at source through Technical Standards for Interoperability (TSIs). The scale of ambition for the scope of source legislation had also increased at DG MOVE. Whereas previously, for example, the focus was only on ensuring that new rail wagon fleets met the more stringent standards, but these only accounted for some 10-15% of total rolling stock, a TSI was adopted in 2014 to extend the scope to existing rolling stock, which will have a much more significant positive benefit in reducing railway noise.

In a recent impact assessment to consider the possibility of extending a TSI on railway noise from new wagons to existing rail wagon fleets, among the policy options considered was a scenario in which the END were to be further strengthened in future by imposing common limit values at EU level for all sources. Whilst it should be emphasised that there was no support for a common LV to be applied across all transport sources among END stakeholders interviewed, in the IA exercise, this option scored well in the impact assessment in terms of potentially meeting the policy objective of reducing noise from railways whilst not penalising the competitiveness of the railways sector compared with other transport sources.

Only limited feedback was received from END stakeholders on the extent of contribution of the END to influencing source legislation for the reasons explained earlier. However, the feedback corroborated the messages from EU policy makers, that the END has provided an impetus to revising source legislation. An acoustic consultant in the UK commented for instance that the "simple existence of the END has caused decision makers and those responsible for transport sources to consider noise more than would otherwise have occurred. For example, the existence of the END has caused the rail industry in Europe to look at regulating the source noise of trains through their TSIs".

In the **automotive sector,** Regulation 540/2014 on the sound level of motor vehicles explicitly mentions the potential value of population exposure data in helping to develop a better understanding as to how road noise in particular impacts on health and how it might be reduced in future. It also stresses the role of the END in helping to develop best practice guidance on improving road quality and on the classification of road surface types, which could make a significant contribution to reducing noise at source.

Furthermore, the END also provided a strategic backdrop to the adoption of the **European Tyre Labelling Regulation (EC/1222/2009)**. This introduced more stringent limits for European tyres for the labelling of rolling resistance and external noise. Explicit reference was made to the END in the impact assessment[92]. "A labelling scheme for external rolling noise may also contribute to awareness-raising, which is one of the objectives of Directive 2002/49/EC on environmental noise".

[91] An example is the TSI on the interoperability of new rolling stock.

[92] Impact assessment on the labelling of tyres, SEC 2008 2860, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SEC:2008:2860:FIN:EN:PDF

An interview with an EU Industry Association confirmed that the END has had a positive influence on the development of the European Tyre Labelling Regulations.

However, the industry association expressed concerns that manufacturers faced additional substantive compliance costs in meeting the requirements (e.g. redesigning tyres) whereas there is research that suggests that laying quiet road surfaces may potentially have a greater impact than making tyres quieter. There was a concern that there needs to be a fair sharing of the administrative burdens and costs between noise at source and noise at receptor.

Industry associations expressed concerns about the need to ensure an appropriate sharing of the burden between industry, which is affected by noise at source legislation, public authorities, responsible under the END for tackling noise at receptor and other actors, such as road construction companies[93].

In the **aviation sector**, the recent adoption of Regulation (EU) No 598/2014 of 16 April 2014 repealing Directive 2002/30/EC makes explicit reference to the END in the recitals and emphasises the importance of a balanced approach to noise mitigation (as advocated by ICAO). It explicitly mentions in the recitals the adverse health effects of environmental noise and raises the possibility of using information arising from the implementation of Directive 2002/49/EC.

Lastly, although the END has clearly had a positive influence already in the revision of some pieces of source legislation, it should be recalled that there are many other factors that will influence the revision of existing, and the development of new source legislation besides the END. Examples are industry viewpoints on what realistic source limits might be achieved by particular dates during the policy development process, and how new possible limit values on noise at source compare with current levels.

Conclusions - informing source legislation to date

- Overall, the END appears to have had a positive influence on informing the revision of existing EU legislation on noise at source and in the development of new Technical Specifications for Interoperability (TSIs);
- The END has been explicitly referenced in the recitals of a number of different pieces of source legislation[94] in the automotive, railways and airports sectors and in the impact assessment accompanying these legislative proposals (see legal mapping), with evidence of much greater attention to environmental noise in the legislation in the past three years;
- Due allowance should also be made of the fact that it will take time for the EU legislative review cycle in respect of other source legislation to be completed, since source legislation is typically only reviewed and revised once every 10-15 years.
- However, since complete and comparable END data produced on a common basis was not available, data has not yet been used to inform the revision of key aspects of source legislation, notably the review of existing limit values and establishing whether or not these should be made more stringent; and

[93] It was noted that whilst tyre manufacturers are subject to noise at source legislation, road construction companies are able to decide whether to lay quiet road surfaces or to take noise into account from the outset of the road design process without any mandatory requirements.

[94] See Regulation (EU) No 598/2014 (noise-related operating restrictions at Union airports), Regulation (EU) 2015/429 setting out the modalities for the application of charging for the cost of noise effects of freight rolling stock, Regulation 1304/2014 on the technical specification for interoperability relating to the subsystem rolling stock noise, Regulation 540/2014 on the sound level of motor vehicles and of replacement silencing systems (automotive)

Contribution to informing source legislation in future

EU policy makers interviewed noted that in future, population exposure data collected at EU level through the END was likely to be **increasingly important.** Whilst such data can in theory already be utilised, it was noted by officials from DG GROW that ensuring data completeness and comparability are crucial precursors to being able to use the data more extensively in impact assessments, for instance, to help to justify making limit values more stringent.

The END is also likely to continue to play a crucial role at the impact assessment stage, especially since the Impact Assessment procedure has recently been further strengthened. In particular, in June 2015, the Impact Assessment Board was replaced by the **Regulatory Scrutiny Board**[95]. Since this will lead to closer scrutiny of proposed EU legislative changes (through continued internal scrutiny, but also the introduction of external scrutiny), policy makers reviewing source legislation will need to ensure that their impact assessment includes data to support any proposed changes to limit values.

Therefore, for the future, it can be concluded that population exposure data is likely to be used more extensively to help establish the baseline situation in respect of noise at receptor and to shed light on the net benefits of existing source legislation.

3.2.3.7 *Impacts of the END's implementation*

The quantitative benefits relating to the implementation of individual measures identified in NAPs under the "efficiency" section have fed into the cost-benefit assessment. However, the impacts of the END's implementation to date that can be assessed qualitatively are considered under the 'effectiveness' criterion. Stakeholders interviewed pointed out that the END has achieved benefits of a more strategic nature relating to environmental noise management that extend well beyond the individual measure level.

EQ9 - What are the main impacts of the Directive?

Among the sub-questions considered were:

- EQ9a How far has the Directive achieved any significant changes (positive or negative)?
- EQ9b Has the Directive contributed to ensuring that by 2020 noise pollution has significantly decreased?
- EQ9c Can any unexpected or unintended consequences be identified?
- EQ9d. To what extent can these be quantified?

EQ9a How far has the Directive achieved any significant changes (positive or negative)?

Several interviewees stated that the benefits of the END should not only be assessed quantitatively at the measure level (here, reference should be made to the cost-benefit assessment in Appendix D), but should also be assessed qualitatively at a strategic level through the effectiveness evaluation criterion.

A further issue raised at the validation workshop was that it is too early to assess many benefits, given the long-term nature of tackling noise at receptor, the types of measures envisaged in NAPs, and budgetary restrictions due to the global economic and financial crisis in many EU MS in R1. Notwithstanding these challenges, a number of stakeholders

[95] http://ec.europa.eu/smart-regulation/impact/iab/iab_en.htm - the Regulatory Scrutiny Board provides a central quality control and support function for Commission impact assessment and evaluation work. It was set up on 1 July 2015 and replaced the Impact Assessment Board.

observed that the implementation of the END has had different types of positive impacts on the management of transport noise across the EU. These are now summarised.

Awareness-raising and coordination across different policy areas

- The END has promoted a more strategic approach to environmental noise management, mitigation and reduction through an action planning approach;
- The END has helped to strengthen the visibility of environmental noise and the adverse health effects of high levels of noise (at receptor). Consequently, there is now greater political attention to the issue of environmental noise and the link with public health in all MS (and to some extent globally);
- Heightening awareness among other policy makers (e.g. transport planning, infrastructure development, urban development and planning) about the importance of building in environmental noise mitigation and abatement from the outset of the legislative-making, policy-making and programme design process
- Strengthening coordination and cooperation between civil servants responsible for environmental noise and other policy areas. This was widely seen as vital since expenditure measures that help to reduce noise pollution are often primarily driven by other drivers, such as air quality, road safety, urban development;
- The END has promoted "joined-up" working between different stakeholder organisations, often with contrasting roles and responsibilities e.g. noise-making (roads authorities) and noise-receiving (housing and planning authorities) responsibilities and wider stakeholders responsible for public health (**NL, IE, UK**).

A common noise assessment framework

- The END has created a common reference framework for assessing noise using common noise assessment methods across EU-28. Putting in place two common EU-level noise indicators (L_{den}, L_{night}) for the purposes of implementing the END has had a positive impact in strengthening the comparability of data, since previously different types of noise indicators were used in different MS;
- The development of the CNOSSOS-EU methodological framework and the subsequent adoption of Commission Directive (EU) 2015/996[96] of 19 May 2015 is a major achievement that took into account scientific and technical progress, as well as state of the art.

The development of noise maps and gathering of population exposure data over time series to facilitate policy-making.

- The END has made information on the level of noise exposure (from road and rail in particular) available to many EU citizens who previously had little or no access to information of this type, although very few citizens are presently accessing noise maps or population data (a reflection of the lack of cumulative maps to show the actual situation as experienced by residents);
- For EU policy makers, the noise maps provide population exposure data by source, which is useful for assessing the effects of existing source legislation and for considering its potential revision;
- For national and sub-national policy makers, the maps and exposure data provides objective support to help prioritise environmental noise interventions.

[96] Commission Directive (EU) 2015/996 of 19 May 2015 (establishing common noise assessment methods according to Directive 2002/49/EC)

Strengthening assessment methods to quantify the health effects of noise

- The END has made noise data available that has provided a means for monetising the impact of noise, for determining the overall environmental burden of disease, and to facilitate several epidemiological studies on noise and health that would have been prohibitively expensive and perhaps impossible to undertake otherwise.

The prioritisation of noise

- In addition to focussing attention on areas that have the highest levels of noise exposure, noise mapping through the END has promoted greater interest among national policy makers in the high numbers of people exposed to low to medium levels of noise;

Quiet areas and the preservation of noise quality where it is good

- There has been growth in interest in the protection of quiet areas, and in more nuanced approaches to protecting special acoustic environments, to protecting tranquillity and to the emergence of soundscape as an important issue; and
- However, the lack of designation of quiet areas to date in many MS has undermined progress in preserving noise where it is good.

There was only limited feedback on negative impacts, since most negative points related to outstanding implementation challenges. Those raised were that:

- A small number of stakeholders were concerned that the costs of strategic noise mapping could divert resources away from environmental noise mitigation, abatement and reduction measures. However, balanced against this was evidence that the full benefits of strategic noise mapping will only be realised over the longer term, especially insofar as informing source legislation is concerned.

EQ9b Has the Directive contributed to ensuring that by 2020 noise pollution has significantly decreased?

Methodological issues – assessing the END's contribution to reducing noise pollution

In addressing this question, it is important to recall the evaluability challenges in assessing the END's contribution to objectives that are not explicitly set out in the legal text of the Directive (see intervention logic, Section 3.1.4).

Since the END's first objective is to define a common approach, it is difficult to assess the END's contribution to reducing noise pollution in the EU at receptor, since there is **no explicit mandatory requirement to reduce noise or to implement measures** identified in NAPs. Assessing the contribution of the END is further complicated by the fact that **there is no systematic reporting at EU level as to which measures included within NAPs have – and have not – been implemented.** A final methodological challenge is that since many measures within NAPs take considerable time to implement, many workshop participants were of the opinion that it is too early to capture the totality of measure-level benefits over the lifetime of measure implementation (since the benefits often considerably lag the costs).

It was noted that it is difficult to attribute the benefits achieved at the measure level solely to the END, since these were often driven by other policy needs (e.g. road safety, air quality, transport infrastructure planning), but with important secondary benefits in terms of contributing towards the mitigation and / or reduction of environmental noise. Moreover, many of the R1 measures identified were already planned before the END was adopted, at least those measures in Germany, which also raises attribution issues.

The question of attribution is addressed in detail earlier in the efficiency section in further detail.

Cost-benefit benchmarks and the distribution of benefits

The work carried out to develop **cost-benefit benchmarks** draws on the study team's extensive knowledge across different EU MS as to what level of noise reduction can be expected from particular types of measures. This has strong potential to help CAs to develop a better understanding of the magnitude of benefit from the different types of measures.

The effectiveness of measures can be assessed through a review of the level of noise reduction achieved, information which is generally included in the NAPs. Estimates of the level of noise reduction can be applied in situations where the NAP does not contain sufficiently detailed data. Therefore data from similar cases was evaluated and applied to the specific case. As a result, generally accepted average noise reduction levels are available for each measure, as shown in the following table.

Table 3.3 - Benchmarks for the order of magnitude of dB reduction for common measure types

No.	Measure	Effectiveness (reduction of noise level)
1	Rehabilitation of roads / Low noise road surfaces	L_{den}/night = -4 dB(A)
2	Speed reduction	L_{den}/night = -2 dB(A)
3	Speed control	L_{den}/night = -1 dB(A)
4	Re-distribution / Reduction of number of heavy trucks	Reduction of affected residents by 20 %
5	Barriers / Walls	L_{den}/night = -3-4 dB(A)
6	Embedded tracks for trams	L_{den}/night = -3 dB(A)
7	Acoustical grinding of tracks	L_{den}/night = -4 dB(A)
8	Vegetated tram tracks	L_{den}/night = -2 dB(A)

Source: ACCON – notes, the values are generally accepted estimates.

Work has been carried out to determine the number of residents with reduced noise exposure across the 19 selected test cases (see Appendix F). The test cases consider changes across at least four 5 dB noise intervals. It could be that there simply are no changes at the lowest or highest intervals. In addition to this information, most NAPs provide an estimate of the expected reduction of noise in dB (A). Using this information, the affected residents are reassigned to lower noise classes according to the specific reduction of the measure. The following example shows the approach applied for a reduction of 2.5 dB (A) (L_{den}):

Table 3.4 – Example as to how the benefits of END measures lead to reductions in noise pollution distributed across 5dB thresholds

Noise level class	Residents without measure	Residents with measure	Comment
<50	1,000	1,000	All residents below level of 50 dB (A).
50-54.9	0	500	Reduction of 2.5 dB(A) results in **shift** of 50 % residents to the lower 5 dB(A) noise-class, whereas the remaining 50% **remain** in the 5 dB(A) noise-class.
55-59.9	1,000	1,750 + 500	
60-64.9	3,500	1,500 + 1,750	
65-69.9	3,000	750 + 1,500	
70-74.9	1,500	750	
>75	0	0	No residents in this class.
Total	10,000	10,000	All residents benefit from the measure.

In the above example, it was assumed that all residents in the case study area who are adversely affected by noise experience a reduction in noise exposure due to the measure being implemented. This effect is expected from measures such as speed reduction, noise optimized surfaces or embedded tracks for trams. In other cases only selected residents from a case study area may benefit from the measure e.g. insulation of windows through noise proofing.

It is difficult through noise mapping to measure changes in noise exposure as a result of sound-proofing measures since there is usually no data as to where the specific beneficiaries of such measures reside. This is because they will still appear in noise maps as being resident in areas with high noise levels, even if measures have been taken to mitigate noise in their specific dwelling.

Quantitative work carried out for the test cases provides a bottom-up assessment of the level of reduction of noise in 19 cases. The CBA then provides an extrapolation based on this data as to the contribution of the END overall. Due to the limited amount of data, the 19 cases had to be selected on the basis of data availability, rather than how representative they may be of the EU-wide situation. Adjustments have therefore been made where considered necessary.

How far have measures in the NAPs actually gone ahead? A lack of reporting data

There is a mixed picture in terms of whether spending measures identified in NAPs have actually been implemented. The economic downturn from 2007 may have, at least in part, reduced the ability of responsible authorities to implement all of the measures identified in their NAPs. Information from stakeholders has, however, confirmed that many measures were still implemented. For instance, public authorities in the Netherlands confirmed that they had spent several million EUR on quieter road surfaces in some cities. In the UK, the major airports, such as Heathrow and Gatwick are expected to spend several million EUR on the noise insulation of windows over a 5 year period.

Such examples, when combined with the examples of completed measures from the 19 test cases (see Appendix F and the findings from the case studies, a summary of which has been incorporated into the efficiency section within the CBA), demonstrate that at least some measures have gone ahead. It can reasonably be assumed that the END has made a positive contribution to reducing noise pollution on the basis that many measures have gone ahead, and this can at least in part be attributed to the END. The significance of this contribution is examined below.

Extent of contribution to noise reduction – experience from the case studies

The points identified above mean that at this stage in the END's implementation lifecycle, some speculative assumptions are required, albeit based on the interview feedback, as to what magnitude of reduction in the level of persons exposed has been achieved to date. Since there is no systematic measure-level reporting information available as to which NAP measures were implemented in full, partially or not at all, the level of reduction in persons exposed has been assessed based on the case studies.

Although there are uncertainties due to there being no formal mechanism for collecting or reporting of information on progress with respect to the implementation of measures, the test cases provided evidence that while some measures had gone ahead and been implemented as planned in R1, others had not gone ahead, either due to budgetary constraints, or the fact that some NAPs adopted a 'long list' approach in which only some measures are ever likely to be implemented.

The most commonly applied expenditure measure in the case of airports was the insulation of windows (this was also the measure incurring the greatest capital expenditure) In the case of major roads, the laying of quiet road surfaces and the installation of noise barriers was the most commonly applied expenditure measure. However, other types of measures which may not require much, if any expenditure, such as the introduction of speed reductions and speed controls, will also have had a positive impact on reducing noise.

Estimates of the level of reduction in population exposure are now provided. The cost-efficiency of measures is examined in EQ13, where the focus is on the degree to which noise measures have contributed to noise reductions and whether the benefits justify the costs.

The implementation of measures identified in the test cases was found to have made a **positive contribution to reducing noise pollution**. The table below provides an indication of the reduction in number of people affected by each of annoyance and sleep disturbance across the 19 case studies and for each noise source. Note that these estimates are not extrapolated, but represent an aggregate of the benefits over all the 19 test cases. As such, they do not reflect the full extent of the beneficiary population from the measures identified in the action plans as noise reductions were only estimated for a limited number of measures, since data is not available for all measures, and not all measures in the NAPs included within the case study selection have yet gone ahead. However, many of the measures are still underway and therefore the figures below represent the size of the beneficiary population in future (i.e. once the measures considered have been fully implemented).

Table 3.5 - Change in the size of the population exposed to noise due to case study measure implementation

Change in the size of the population:	Major roads (n=2)*	Major railways (n=2)	Major airports (n=5)	Agglomerations (n=6)
Annoyed	40,777	7,924	27,356	74,440
Highly annoyed	18,685	3,256	12,833	38,859
Sleep disturbed	22,037	2,228	19,593	38,479
Highly sleep disturbed	10,044	1,020	12,312	18,710

* n = number of case studies from which the estimates are derived

These estimates suggest that the benefits from efforts to reduce noise from all sources across the EU-28 are likely to be substantial, even if only a proportion of the total benefits can be attributed to the END

Conclusions – contribution of the END to noise reduction and the 2020 targets

- The END has already begun to make a positive contribution to reducing noise, although fewer R1 measures went ahead than expected due to the global economic and financial crisis which affected budgets severely in many EU MS.
- At an EU level, the absence of reporting data on measure implementation across the EU as a whole means that it is not possible to quantify the contribution of the END to noise reduction precisely.
- Nevertheless, the cost and benefit benchmarks derived through this study by type of intervention (e.g. noise barrier, quiet road surface, speed reduction / traffic calming measure, etc.) should help to strengthen the assessment of the extent of contribution of the END in future.
- The findings from the test case data suggest that END measures have made a valuable contribution to reducing population exposure. It should, however, be noted that for some types of measures, the net benefit cannot fully be assessed in subsequent mapping rounds because of the way in which population exposure is measured (e.g. noise insulation of windows may not show up in noise maps which measures noise outside rather than inside buildings).
- However, some adjustments can be made in carrying out mapping in order to take measure implemented into account based on the size of the insulation programme/ no. of dwellings that benefited from a particular measure.
- Although some measures have not yet been implemented and some are still underway, the benefits may not be realised for a few years. However, it can be assumed that the measures will be implemented (or at least get underway) by 2020 and the over-estimation of benefits by this date may be counter-balanced by the fact that we neither include benefits for the measures for which no cost data was available nor the value of benefits associated with those that only suffer from low or moderate sleep disturbance and annoyance.

EQ9c Can any unexpected or unintended consequences be identified?

EQ9d. To what extent can these be quantified?

NGOs and community organisations broadly welcomed the introduction of the END as having strengthened the political visibility of and the degree of policy attention to environmental noise. However, some such organisations interviewed were concerned about the potential unintended consequences, such as the **risk that the costs of noise mapping might displace funding** that would otherwise have been used directly for noise mitigation, abatement and reduction measures. However, the costs of END implementation have been estimated by national CAs under the efficiency criterion (see Section 3.4.2, which quantifies the estimated administrative costs of END implementation in each EU MS).

Since according to cost benchmark data provided by acoustics consultancies, the total average costs per affected inhabitant are typically around €1.50 to €2.00 (and about half that for the total population), this does not suggest that the costs associated with implementing the END have displaced funding intended for mitigation measures. Conversely, although some non-spending measures have been adopted, implementing noise mitigation measures is often considerably more costly than the administrative costs, which are marginal compared with the substantive costs of measure implementation.

Some public authorities expressed a similar concern about the costs of mapping and whether there was a risk that if noise mapping goes beyond its original strategic function and becomes more detailed, then the costs will detract from noise reduction measures. This comment related specifically in relation to the future implementation of Commission Directive (EU) 2015/996. However, most stakeholders interviewed did not view the mapping requirements as being too detailed (although this was contingent on how the particular EU MS had decided to organise noise mapping since the level of administrative burden was perceived to be greater when noise mapping was carried out for too small administrative units

An unforeseen impact of the END was the use of **noise map** data by stakeholders outside those directly involved in implementing the END. For example, noise mapping data is being used for research purposes, particularly in large scale epidemiological studies, sometimes funded by the EU itself. Similarly, noise map data is being used in some MS for land use planning purposes, assisting in decision-making on future land use, particularly for new transport infrastructure and new noise sensitive development.

Several respondents raised concerns about END data being used beyond what it was originally designed for, expressing concern that **the consequences of any assumptions and limitations were not always appreciated, or even brought to the attention of the end user**.

Another positive, probably unexpected consequence of END is that Europe is perceived to be at the forefront of **strategic noise management across the world**. Evidence from international acoustics conferences and social media discussions suggests that many other MS are looking to the EU (and WHO Europe) to take the lead in highlighting noise as a public health hazard and to find ways to tackle the issue in the future.

There are a wide variety of different types of **Noise Action Plans** being prepared by MS. It is not clear whether this is an intended or unintended consequence. The flexibility available in END appears to allow MS to decide whether to prepare strategic action plans containing long-term policies and tentative measures, or whether to prepare detailed local action plans with specific timetables and costed noise management interventions.

There was some concern when the END was adopted that **publishing NAPs** may have increased public expectations for noise control interventions at a time when resources are scarce. The research identified that this was a problem in some MS. For instance, in **France,** evidence emerged of a reluctance among some local authorities at the *commune* level to publish NAPs unless measures had a dedicated budget allocated. Otherwise, there was a perceived risk that this would create a reasonable expectation among citizens that the actions identified would be implemented.

However, it was not considered realistic for most expenditure measures to be implemented, since local authorities responsible for action planning had almost no budget to deliver and implement measures in agglomerations. There was even a reluctance among some communes to publish noise maps with population data on the number of persons exposed at particular dB thresholds, again for fear that this would create an expectation for follow-up actions, one that there was no budget to support. However, the evaluators note that lack of budget among public authorities is not a reason to hide health-related information from citizens.

The situation was very different however for major roads and major railways, since these are a national competence under the Ministry of Infrastructure (implemented on a regional basis by departmental representatives from the Ministry), and the French state pays for both the development of SNM and identifies funding for measures.

The END is not prescriptive about the identification and management of **quiet areas**. Indeed one view expressed by several respondents was that the original intention of END was to discourage a noise problem being moved from one location to another e.g. by moving flightpaths, or perhaps by creating a bypass. It could be argued that the widespread interest in quiet areas, in the protection of tranquillity and in the **rapidly developing field of soundscape research is an unexpected, perhaps positive outcome of the END**. In several MS the benefits of a good acoustic environment are now recognised and are beginning to be protected, in addition to ongoing efforts to reduce the adverse impacts of noise. At the same time, respondents have expressed concerns that measures to identify and protect Quiet Areas may constrain the future use of that land for other purposes.

There were also concerns that designation as a Quiet Area, on the sole issue of low noise levels alone, would not properly take into account the other uses of the area such as for exercise, for recreation, music and other cultural festivals etc. There are wider concerns that formal identification of land as a Quiet Area might constrain future industrial, commercial or transportation development in the vicinity of a Quiet Area in a way that does not properly take into account the wider benefits of the proposed development. These are important concerns relating to the future consequences (both intended and unintended) of designating Quiet Areas. Whether these issues were wholly anticipated at the outset or not, they partly explain why relatively few Quiet Areas have been formally identified to date.

One of the perceived weaknesses of the END, according to some of the stakeholders interviewed (e.g. in NL, IE, the UK) was that the END appears to treat noise in isolation of **wider social, economic and other environmental factors**. For example, the need to provide additional housing needs to be balanced against any possible adverse effects of outdoor noise. In addition, the Directive itself does not make specific reference to the need to achieve synergies with other environmental issues such as the interface between noise action planning and the development of air quality action plans.

Lastly, some potential consequences of the END when the Directive was initially adopted have turned out to be unwarranted. For instance, there was a concern that publishing noise maps might affect property prices. However, no evidence could be obtained that this was the case either in R1 or R2 in any EU MS.

EQ10 - How have the provisions of the Directive been accepted by the stakeholders? In particular, how have each of the following END provisions been accepted?

a) Noise measurement through a system of common indicators and a common methodology (CNOSSOS-EU);

b) Noise mapping;

c) The preparation of action plans;

d) Information and consultation of the public; and

e) Reporting to the EC and reporting by the EC under Art. 11.

Some feedback was received in respect of the extent of acceptance by stakeholders of the different actions. It should be noted that this question is of a cross-cutting nature, and has therefore been addressed in greater detail in both the implementation and evaluation parts of the report under the respective headings relating to these actions.

Overall, the main finding was that the three actions required under the END set out in Art. 1(1a, 1b and 1c) of the Directive (noise mapping, information and consultation with the public and action planning) are **widely accepted by stakeholders.**

a) Noise measurement through a system of common indicators and a common methodology (CNOSSOS-EU)

As detailed under 'effectiveness' (progress towards a common approach), the introduction of **common EU-wide noise indicators** (L_{den} and L_{night}) through the END has been broadly welcomed by stakeholders since it provides a common basis for collecting population exposure data across the EU. Although some MS continue to use additional noise indicators, stakeholders viewed the use of two key metrics as being an effective means of establishing the baseline situation across EU-28 and the reporting on this in five yearly cycles.

The CNOSSOS-EU process leading up to the development of a **common assessment methodology** at EU level was accepted by the majority of stakeholders in the field of environmental noise. However, as detailed in Section 2.3.7 (strategic noise mapping) in the implementation part and in Section 3.2.3.2 (effectiveness), some MS were reluctant to relinquish their own national and interim assessment methods used under Annex II even if they accepted the usefulness of CNOSSOS-EU for reasons of comparability. There were concerns about whether the new common approach would deliver improved data compared with existing methods in some of the Scandinavian MS.

The fact that the costs of noise mapping were found to have diminished in most EU MS between R1 and R2 may indicate that the **costs are likely to become more acceptable to stakeholders over time,** especially as the full benefits of the legislation's implementation begin to materialise and become more visible (e.g. the use of data by national authorities for benchmarking purposes and EU policy makers).

b) Strategic Noise Mapping

Whilst there was acceptance that producing data based on common noise assessment methods was essential to inform source legislation, there were different levels of acceptance among public authorities of the costs involved, depending on how useful different public authorities found the maps and the exposure data. As noted earlier in the sub-section on the 'utility of END data' within EQ7(a), whilst national and regional CAs and those in larger cities appreciated having access to the population exposure data produced through the END, some local authorities in localities with a small population and in rural areas were sceptical whether noise mapping justified the costs.

This appeared to reflect a misperception among local authorities about the purpose of data collection under the END, which is primarily concerned with ensuring that EU-wide data is produced on a common basis so as to inform source legislation. Whilst the data is useful for many different purposes even in remote and rural locations, such as providing an overview of the baseline situation and helping to identify mitigation priorities, the EU-level focus may not be clear to all stakeholders.

Since the research has shown that the costs per affected inhabitant and the costs per inhabitant among the total population of strategic noise mapping are low, it is also worth pointing out that perceptions of costs also vary depending on national arrangements to fund noise mapping. In **France**, for example, although the state pays for noise mapping for railways and major roads, local municipalities must pay for noise mapping within an agglomeration out of their general budget. Therefore, although the costs may be low in absolute terms, the costs are perceived as being high in a small commune where budget for noise mapping has to come from the general budget and there is no dedicated state funding provision made available.

c) The preparation of Noise Action Plans

There was also acceptance of the need for an **action planning approach**. As detailed earlier, stakeholders accept the need for a common framework at EU level, but with significant flexibility afforded to the Member States under subsidiarity as to how to develop action plans. For example, an airport operator that took part in the workshop stated that even were the END to be repealed, they would continue engaging in action planning on a five yearly cycle because it provided a mechanism through which they could communicate with external stakeholders and bring together all noise-related actions into a single document. This helps to demonstrate that many stakeholders value the more strategic approach that a five yearly action planning cycle through the END brings. This was confirmed for example not only through the interview programme with CAs, but also in the written submissions received from stakeholders in response to the publication of the September 2015 Workshop Working Papers[97].

d) Information and consultation of the public

There was broad acceptance of the need to **carry out public consultations** and to keep the public informed about the results of noise mapping and action planning processes. However, as detailed in Section 3.2.3.5 on public consultations, there were concerns among some END stakeholders that consultation could be made more effective by targeting only those stakeholders that are well-informed and able to contribute to strengthening action planning. There was a view that whilst informing the public is useful from an awareness-raising perspective, without a more focused process, it is less likely to result in meaningful feedback that can be used to strengthen the quality of both NAPs and the mitigation measures identified within NAPs.

e) Reporting to the EC by the Member States and reporting by the EC under Art. 11.

With regard to **information and reporting requirements under the END,** although there was broad acceptance that data had to be submitted, there were concerns among some stakeholders about the 12 month timescale between the submission of reporting information on noise maps and population exposure and the submission of NAPs. The main issue identified was therefore not the type of reporting information, but rather Member State-specific issues as to whether they could deliver the required reporting information by the deadlines stipulated in the Directive.

[97] http://ec.europa.eu/environment/noise/evaluation_en.htm

Most MS were content with the guidelines and reporting templates for the Reportnet system to capture reporting information relating to compliance with the Directive. The reporting system was felt to be proportionate and was viewed as being user-friendly.

However, a number of stakeholders expressed the view that reporting information requested by the EEA has sometimes gone beyond what is implied by strategic noise mapping in the Directive itself. An example provided was that in Annex VI, population exposure data by noise class is required in the hundreds only, but since many MS have reported on the precise number of inhabitants affected in each 5dB noise class, other CAs have now been asked to do likewise in reporting on population exposure data by the EEA. This was seen by some stakeholders as going beyond the concept of *strategic* noise mapping.

3.2.4 Efficiency

Efficiency can be defined as the extent to which the desired effects are being achieved at a reasonable cost. It provides an assessment of the relationship between the resources deployed (inputs, measured in terms of human and financial resources) and the results that have been achieved (*outputs, results* and *impacts*).

In this section, a number of different issues related to the efficiency evaluation criterion are considered, namely:

- Methodological issues in assessing the efficiency and cost-effectiveness of the END (see Section 3.2.4.1).
- An assessment of the findings in respect of the administrative costs of END implementation at EU and national level (see EQ11 in Section 3.2.4.3);
- An examination of alternative ways of reducing the level of administrative burdens from END implementation, and possible means of simplifying the END (see EQ11c);
- An assessment of the efficiency of END Reporting Mechanism (see EQ12 in Section 3.2.4.3);
- A detailed summary of the findings from the cost-benefit assessment (CBA) in relation to the substantive compliance costs of implementing measures (see EQ13 in Section 3.2.4.5); and
- Overall findings in respect of efficiency.

It should be noted in relation to the CBA that the detailed methodology underpinning the CBA findings is presented in Appendix D. The measure-level assessment of costs is set out in the case studies in Appendix F. These take into account the substantive compliance costs of measure implementation as well as administrative costs and provide the basis on which the extrapolation is based.

3.2.4.1 Methodological issues – assessing the efficiency and cost-effectiveness of the END.

The exact nature of the relationship between the costs of END implementation and the benefits is difficult to determine and depends largely on the extent to which costs and benefits can be quantified and compared on a like-for-like basis. It is important to note that the overall cost-effectiveness of the END should be assessed by comparing the level of administrative costs with the benefits and impacts of the END, which include some that can be quantified (measures), but many that are either difficult to quantify or intangible in nature, such as the strategic benefits of noise mapping and action planning as part of a five yearly cycle.

A quantitative assessment of aspects of the Directive's efficiency was possible through a separate assessment of the costs and benefits of noise mitigation, abatement and reduction measures *(see Section 3.2.4.5 - Findings from the cost-benefit assessment).*

While the case studies and the CBA extrapolation provide a useful proxy for efficiency, measure implementation is only one aspect of cost-benefit, and does not capture the totality of benefits.

An assessment of the efficiency of the Directive also needs to consider qualitative benefits (such as a more strategic approach to managing environmental noise, and the promotion of more joined-up working between different government Ministries in respect of environmental noise mitigation and planning). These can only be compared with the costs by making an evaluative judgement as to whether the costs are proportionate compared with the benefits, many of which are of a difficult to quantify, or intangible nature, but which should nevertheless be considered in assessing the EN's overall cost-effectiveness[98].

An additional methodological issue is the fact that the Directive's full cost-effectiveness cannot yet be assessed since it is too premature to do so. Linked to this, cost-effectiveness can reasonably be expected to evolve over time as the Directive becomes better embedded and as the quality and comparability of noise maps and population data improves. For example, the development of common assessment methods through CNOSSOS-EU was resource-intensive at EU level in the early years of its development. It will then require investment by MS to make the transition from national and interim methods to producing noise maps and exposure data based on Commission Directive (EU) 2015/996. This will take place either in Round 3 (on a voluntary basis) or in Round 4 (mandatory). However, assuming that this leads to improved data comparability between Rounds and between MS, this should contribute to strengthening the cost-effectiveness of the Directive in future, since comparable data will be crucial to the achievement of the Directive's second objective (Article 1(2)) of providing a basis for Community measures i.e. informing source legislation.

3.2.4.2 *The administrative costs of END implementation at EU and national level*

EQ11 - How far are the administrative costs of END implementation proportionate?

Introduction

The steps taken to address this EQ were to:

- Gather data on the administrative costs of END implementation at the EU and national levels across EU-28 for each five yearly reporting round;
- Aggregate and analyse the data collected in order to identify the range of administrative costs, and to ascertain the average and median costs;
- Compare the evolution in administrative costs between R1 and R2;
- Compare differences in the level of administrative costs across EU-28 MS, and assess the reasons for any differences; and
- Assess the proportionality of the costs compared to the potential benefits through an evaluative judgment of cost-effectiveness.

[98] See page 46 of the IA guidelines - http://ec.europa.eu/smart regulation/impact/commission_guidelines/docs/iag_2009_en.pdf. This states that: Cost effectiveness analysis: one advantage is that this does NOT require exact benefit measurement or estimation. "It is an alternative to cost-benefit analysis in cases where it is difficult to value benefits in money terms.

The administrative costs of END implementation at EU level

The EC incurs administrative costs in coordinating the reporting and monitoring of END implementation at the European level. These relate, for instance, to collecting data on END implementation (Art. 10) in the form of a relational database of SNMs and NAPs and to meeting the EC's formal monitoring and reporting obligations (Art. 11). An explanation of the specific tasks and activities involved in EU-level aspects of the Directive's implementation was provided in Section 1.5.2 (the role of the EC in END implementation).

The estimated costs incurred at EU level for the EC in coordinating the implementation of the Directive and in carrying out its monitoring and reporting responsibilities (assisted by the EEA) are now provided, to the extent that data was made available.

According to the **EC's DG ENV**, the average administrative costs for the EC of implementing the END are estimated to be €165,000 /year between 2002 and 2013 and €297,000 /year for 2014 and 2015. These estimates include staff costs, attending meetings and missions. The total costs since the END's inception are an estimated €2,574,000. These costs relate to the direct costs of implementing the END.

The EC's **JRC** was involved in the early stages of END implementation (in particular, assisting with the technical process leading to the publication of the CNOSSOS-EU methodology in the 2009 – 2014 period relating to common assessment methods). Although cost data was requested from the JRC, no data was made available in respect of the costs relating to the joint development of the CNOSSOS-EU methodology with DG ENV. In the CBA assessment (see EQ13), assumptions have been developed with regard to the level of staff costs involved (estimated at 0.50 FTEs over a 4 year period of development of CNOSSOS-EU from 2009-2012). It should be noted that the JRC no longer has a role in END implementation.

The **EEA** plays an important supporting role in assisting the EC with some delegated tasks relating to its reporting responsibilities in respect of Art. 11 (Review and reporting) of the Directive. The EC collects strategic noise maps and population exposure data from MS based on information submitted via the EEA's EIONET Reportnet system through a centralised database of SNMs. The EEA then supports the EC in making noise maps and population exposure data accessible online through the EIONET website via the Noise Viewer (www.noise.eionet.europa.eu/). In addition, its staff undertake a quality check to ensure that SNMs meet minimum defined quality parameters.

The EEA noted that the level of human resources increased when reporting obligations commenced in 2005. Data on the actual (financial) costs of the EEA's work on the END are available for the period 2008-2015, whereas the level of human resource input to END implementation by the EEA can only be estimated. Overall, between 2002 and 2015, according to the EEA, costs incurred related to the END were in the order of €1,815,000. There are some uncertainties around this figure, since some data-related reporting has to be carried out anyway for the EEA's broader environmental reporting tasks across EEA33. It is difficult to attribute all the costs directly to the END since the EEA's work on the END also helps in reporting on the state of the environment across a broad range of areas, such as noise and air pollution.

The administrative costs of END implementation at MS level

In this sub-section, the following issues are addressed:

- Explanation of the way in which data on administrative costs at the MS level was collected (and the identification of any data gaps).
- Methodological issues and challenges in estimating administrative costs.
- The costs per capita of strategic noise mapping and action planning.

- An assessment of administrative costs, supported by detailed examples from the MS.
- Human resources allocated to END implementation.
- Trends in the evolution of administrative costs between END rounds.
- Assessment as to whether the costs of END implementation are proportionate.

Approach to data collection on administrative costs and any data gaps

Administrative costs data has been collected in two ways through the study research:

- Data collected through the second implementation review. Data was obtained from 23 national CAs on the estimated administrative costs of END implementation.
- Data collected from acoustics consultancies, which provided supplementary cost benchmark data.

It should be noted that even in MS where national CAs provided at least some data, there remain data gaps since some MS only provided partial data relating to the human and financial resources associated with END implementation at the national level. There were found to be differences in the estimates of the level of administrative costs between those provided by national authorities and the cost benchmarks provided by industry (i.e. acoustics consultancies engaged in producing SNMs and / or supporting public authorities with action planning processes).

Since acoustics consultancies deliver contracts directly for END competent authorities in the public sector, industry data may arguably be more likely to be accurate in estimating the direct financial costs, whereas public authorities are likely to be better placed in estimating the level of human resources required to produce SNMs and NAPs.

The estimated costs by national CAs were acknowledged as being an under-estimate in some EU MS, due to the difficulty in estimating the costs at local and regional levels since there may be many competent authorities involved. In addition to CAs, a wider range of public bodies may contribute indirectly to END implementation (but not be noise action mapping or noise action planning bodies themselves, for instance, through the provision of input data to assist in the noise mapping process). These issues are explained in more detail in the section that follows.

Methodological issues – estimating administrative costs

The following methodological observations can be made in relation to the assessment of administrative costs.

A distinction was made between the *one-off* costs associated with END compliance (such as the purchase of IT equipment and noise modelling software licenses) and the *recurring* costs incurred in each five yearly implementation cycle associated with noise mapping and action planning, such as the costs of procuring external noise mapping services, the human resources required to prepare a NAP (and to undertake a public consultation and analyse the feedback).

Generally, one-off costs were associated with R1 implementation, although some further one-off costs can be expected when Commission Directive (EU) 2015/996 has been implemented, since this will require further expenditure to make the transition from national and interim methods to producing noise mapping data on a common basis. However, the focus of the data and analysis presented in this section is on the costs already incurred.

There were practical difficulties for CAs in estimating the level of human resources devoted to implementing the END. Many CAs were not able to provide data on regional and especially local level implementation, due to the fragmented nature of collecting (and/ or estimating on a top-down basis) such data. It was difficult for them to do so because the data is dispersed amongst so many local authorities. Moreover, there is no requirement in the END to collect such monitoring data, therefore, estimating the data retrospectively to help inform this evaluation study has proved challenging. It was especially difficult to quantify costs in EU MS that have adopted a more decentralised approach. Difficulties were also identified by many CAs in estimating the number of FTEs in their MS that work on END implementation overall. Among the complexities are that especially in agglomerations, staff working on END implementation may only spend 5-10% of their time on the END (concentrated in the first and second years of each five year implementation cycle i.e. on noise mapping and action planning respectively).

Furthermore, interviewees in national CAs stated that even though they were in touch with their counterparts at regional and local level, it was difficult to estimate how many FTEs were involved in total, since many different organisations are commonly involved (across different sources, and both within and outside agglomerations. For instance, within a typical agglomeration, there may be several local municipalities involved in noise mapping, but often the civil servants concerned only spend a small proportion of their time on the END.

Furthermore, in many MS, a large number of different organisations are involved in END implementation, such as CAs carrying out noise mapping and action planning, but also public authorities involved indirectly, for instance, in providing input data and other information to CAs responsible for noise mapping. This complicates the coordination of data collection on costs, since national CAs were often unable to obtain this data.

Cost data was especially difficult to obtain from local municipalities involved in noise mapping and action planning within agglomerations and from public authorities that play an important but more limited role in providing data to facilitate strategic noise mapping. In some cases, municipalities were simply unable to estimate the level of financial or human resources involved, since this data had not been monitored or kept on a disaggregated basis (indeed, there is no requirement to do so under the Directive). Nevertheless, useful data estimates were obtained from some municipalities. Where only partial data was received at local level, an attempt has been made to scale up the data wherever possible, according to the total number of municipalities involved. However, in EU MS that have a highly decentralised approach to END implementation, it was sometimes difficult for them to estimate how many different bodies were involved in activities relating to the END.

EQ11a – How far do administrative costs differ between Member States and between Rounds?

A key question examined relating to administrative costs was how far such costs differ between EU MS. Once examples of differences in cost have been identified, possible factors that may help to explain these differences were then identified and analysed.

The starting point was to review the variances in administrative cost data collected through the study between MS. The table on the following page provides an overview of data gathered from 23 EU MS that responded to a request by the evaluators to provide data in respect of administrative costs. The data was disaggregated by Round (subject to data availability) in order to assess the evolution in costs over time. Data estimates have been provided for financial resources (in €) and human resources (in Full-Time Equivalents, or FTEs). Where this was possible based on the data received, the figures distinguish between the costs related to noise mapping (NM), action planning (AP), and the total costs. It should be noted that this data was received from national Competent Authorities and may thus in some instances exclude resources spent by sub-national CAs or other public authorities on END implementation. As a consequence, the actual

resources spent on END implementation may be higher than the figures in the table suggest.

Wherever ranges are provided, this is based on estimates made by Competent Authorities or relates to the fact that various figures have been given by different sources. These limitations notwithstanding, these figures provide a useful source to draw some conclusions on the cost of END implementation.

Table 3.6 – Human and financial resources devoted to END implementation in Round 1 and 2 (N = 23 EU MS)

MS	Type of resources	Round 1	Round 2
BE	**FTE**[99]	7.8	6.6
	Budget	€ 4,006,144 (NM both Rounds) € 1,861,500[100] (AP R1)	
BG	**FTE**	No data[101]	3.65 - 5.63
	Budget	€ 463,026 (NM) € 66,155 (AP)	€ 1,216,829 (NM) - € 900,000 out of which paid to external consultants € 106,289 (AP)
CY	**FTE**	No data	0.35
	Budget	€ 348,555	€ 315,000
CZ	**FTE**	No data	> 2.8 (NM & AP) 35[102]
	Budget	No data	€ 1,699,409[103] (NM) > € 159,969 (AP) Total: > € 1,859,378
DE[104]	**FTE**	No data	196
	Budget	€ 11,100,000 (NM) € 11,400,000 (AP)	€ 9,200,000 (NM) € 23,500,000 (AP)
DK	**FTE**	0.1-0.5	0.1-0.5
	Budget	€ 60,000 (NM & AP)[105] ~ € 60-70,000 (NM) [106] ~ € 18-20,000 (AP)[107] ~ € 100,000 one-off + 80,000 p.a. (NM)[108] Total: > € 644,000	€200,000-€250,000 (NM & AP)[109] €80,000 p.a. (NM & AP)[110] Total: ~ 625,000
EL	**FTE**	No data	€ 5,500,000
ES	**FTE**	No data	No data
	Budget	~ € 3,825,000 (NM)[111]	~ € 3,739,906[112]
FI	**FTE**	0.65	1.5
	Budget	€ 481,000 (NM)	€ 1,021,000 (NM)

[99] Excludes resources required to action plan mitigating measures

[100] Flanders only. No data available for Brussels. No action plans have been completed in Wallonia.

[101] Although no data could be provided, the CA commented that the FTE in R2 was lower than in R1

[102] 17 internal + 36 external = 63 (no. of staff (NM & AP).

[103] Only for agglomerations (Ostrava, Plzeň, Ústí nad Labem – Teplice, Liberec, Olomouc); for the Václav Havel airport and for major railways

[104] agglomerations only

[105] Copenhagen airport

[106] Major roads only

[107] Major roads only

[108] Municipalities

[109] Major roads only

[110] Municipalities only

[111] Major roads only

[112] Major roads only

MS	Type of resources	Round 1	Round 2
		€ 258,000 (AP)	€ 500,000 (AP)
FR	**Budget**	€ 4,000,000 (NM)[113] € 700,000[114] Additional bottom-up estimates > € 5,000,000 paid to external consultants (NM) €2,500,000 (for the Paris agglomeration alone)[1]	No data was available for FR as a whole. €2,500,000 (NM) for Ile de France and Paris agglomeration. >€2,000,000 (NM & AP) – note, this relates to additional central government funding made available for completion in 500 of the outstanding *communes* municipalities.
HR	**FTE**	N/A (Croatia was not subject to R1 of noise mapping and action planning)	0.84-0.87
	Budget	N/A (Croatia was not subject to R1 of noise mapping and action planning)	€ 564,000 (NM) € 119,000 (AP)
HU	**FTE**	No data	44.66[115]
	Budget	€ 2,615,412[116] (NM + AP)	Total: € 2,887,741 (NM + AP)
IE	**FTE**	>1[117]	>0.78[118]
	Budget	> € 565,000 (NM) > € 64,372 (AP)	€ 1,137,506 (NM)
LT	**FTE**	3.5	1.25
	Budget	€ 132,311 (NM)[119]	€ 600,093 (NM)[120] ~ € 170,000 (NM)[121] € 50,814 (NM)[122] > € 120,035 (AP)[123] € 53,201 (AP)[124] € 44,000 (AP)[125] Total: >€1,038,143
LV	**FTE**	12.2 (NM & AP)	10.5 (NM & AP)
	Budget	€ 322,000 (NM) € 197,000 (AP) Total: € 519,000	€ 170,905 (NM) € 82,558 (AP) Total: € 253,463[126]

[113] Major roads

[114] Major railways

[1] Note – this data estimate was provided by an END stakeholder, and not an official source. It is based on bottom-up estimates with regard to the number of noise mapping bodies contributing to mapping in agglomerations (240) and the average costs of using an acoustics consultancy to produce the noise maps.

[115] This number includes 32 FTEs amongst local authorities.

[116] Only for Budapest agglomeration

[117] National CA only

[118] National CA only

[119] Major roads only

[120] Agglomerations only

[121] Major railways

[122] Major roads

[123] Excluding all but one agglomeration, so actual cost could potentially be much higher

[124] Major roads only

[125] Major railways only

[126] Including one-off costs at airport

MS	Type of resources	Round 1	Round 2
MT	**FTE**	1.2	0.1
	Budget	€ 70,000	€ 55.000
PL	**FTE**	0.8-1.8	2.9-3.6
	Budget	No data	> € 2,815,000 (NM)
PT	**FTE**	> 6.3-6.5[127]	> 3.3[128]
	Budget	> € 1,350,878 (NM)[129] > € 436,100 (AP)[130] Total: > € 1,786,978	> € 1,605,825 (NM)[131] > € 528,910 (AP)[132] Total: > € 2,134,735
RO	**Budget**	€ 2,673,223 (NM)	
SE	**Budget**	No info	€ 2,150,000 (NM + AP)[133]
SI	**Budget**	€ 63,000[134]	No data
SK	**FTE**	0.01[135]	0.01[136]
	Budget	€ 2,650,000 (NM) [137] € 334,000 (AP)[138] Total: € 2,984,000	€ 3,030,000 (NM)[139]
UK	**FTE**	13.2	7.8
	Budget	€15,400,000 (NM)[140] € 5,600,000 (AP) Total: € 21,000,000	€3,500,000[141] (NM) € 700,000 (AP) Total: € 4,200,000
Sum 23 MS	**Budget**	**Total: € 75,768,993**	**Total: € 75,789,674**

Source: own analysis based on administrative costs data provided by national CAs and occasionally supplementary sources. The national CAs have in some cases consulted with a range of other CAs in order to estimate costs.

Given the methodological challenges in estimating FTEs explained earlier, an estimated range was sometimes provided for the number of staff involved in END implementation. Furthermore, in some MS, although the national CA was the main source of data, data was received in respect of the estimated number of FTEs from different sources, including contributions by other CAs and the country report experts. Some MS were unable to estimate the number of FTEs and could only provide details for staff that worked on the END for at least some of their time, since they were unfamiliar with how to estimate FTEs.

In the column estimating FTEs, in several instances, the number of FTEs relates to the national CA only, since they were not always able to quantify how many FTEs were involved at local and regional levels of governance, especially when multiple organisations were involved in MS that have adopted decentralised implementation approaches.

[127] Excluding agglomerations other than Lisbon
[128] Excluding all agglomerations
[129] Excluding 65% of major roads; including action planning for airports
[130] Excluding 65% of major roads
[131] Including €931,780 budgeted for major roads; including action planning for airports; excluding agglomerations, 65% of major roads
[132] Including € 430,910 budgeted for major roads; excluding 65% of major roads
[133] Agglomerations only based on scaling-up the detailed estimated costs provided by one out of 13 municipalities.
[134] Only Ljubljana agglomeration
[135] Airport only
[136] Airport only
[137] Excluding airport and major rail
[138] Major roads only
[139] Excluding airports
[140] Note: an exchange rate of €1.40/ £1 was applied in both R1 and R2 since the original figures were provided in £'s for both rounds.
[141] Idem.

The data provided by MS in Table 3.6 is heterogeneous partly because of challenges in collecting reliable data estimates since no monitoring data of administrative costs was collected, but equally because EU MS devote differing levels of financial and human resources to the END. Secondly, there are difficulties in comparing the level of financial and human resources allocated by national CAs across different EU MS due to wide differences in implementation approaches. Thirdly, there are uncertainties with regard to the reliability and comparability of the data collected. Although the evaluation scope covers the period 2002-2015, more recent data relating to R2 implementation is likely to be more reliable, since it was more difficult for CAs to obtain R1 cost data dating further back in time (e.g. due to staff changes, the absence of an obligation to monitor such costs in the END monitoring and reporting system).

These limitations notwithstanding, as shown in Table 3.6 above, the **administrative costs** of implementing the END were found to have remained stable between rounds with €75.8m being spent in each by 23 EU MS who provided data. By comparing the values in the table to the total population of the countries, one can calculate the average cost per capita for each Round based on the sample of 23 Member States. This can then be extrapolated to the EU level by multiplying the average with the total population of the EU28. The corresponding figures are €80.3m (R1) and €107.4m respectively (R2), showing an increase in cost in R2. However, it should be recalled that there has been an approximate doubling of noise mapping and action planning requirements in R2 due to the transition to the definitive END thresholds. The modest increase in costs suggests reductions in the costs of procuring external noise mapping services and the absence of one-off costs in R2. If such cost savings had not incurred, the substantial increase in the amount of mapping and action planning required in R2 compared to R1 should have resulted in a much starker increase in the overall cost.

The costs per capita of noise mapping and action planning

A more meaningful comparison of costs necessarily takes into account the costs *per capita,* using the total population in each MS as a basis rather than only the population affected by noise, since measures are ultimately paid for by the public sector from tax revenues[142]. The table below compares the costs *per capita* of noise mapping and action planning for a sample of MS for which this data was made available in Round 2. The data should be broadly representative, since it includes both large and small MS and MS with different approaches to END implementation. The table focuses on R2 costs only since the cost estimates for R1 may include distorting one-off costs and are thus less instructive in terms of assessing the longer-term five yearly implementation costs[143].

[142] Source: http://ec.europa.eu/eurostat/statistics-explained/images/7/7a/Demographic_balance%2C_2014_%28thousand%29_YB15_II.png

[143] Croatia is an exception since it did not participate in R1.

Table 3.7 – Administrative cost of noise mapping and action planning per capita in sample of Member States (total Round 2 costs)

Member State	Noise mapping cost in € per capita[144] rounded in R2	Action planning cost in € per capita rounded in R2
Bulgaria	0.17	0.01
Croatia	0.13	0.03
Czech Republic	0.16	0.02
Finland	0.18	0.09
Germany	0.11	0.29
Latvia	0.09	0.04
Lithuania	0.28	0.07
Poland	0.07	no data
Portugal	0.15	0.05
Slovakia	0.56	no data
United Kingdom	0.05	0.01
Average (arithmetic mean)	**0.18**	**0.06**
Median	**0.15**	**0.03**

Source: own calculations based on cost data provided by national CAs set out in Table 3.6. The focus is on R2 since cost data estimates for R2 are likely to be more reliable than those that date back a considerable time period.

As the table above shows, even when population size has been taken into account, the **relative costs of producing SNMs and NAPs varies considerably between MS**. Whilst the average amount spent per capita on noise mapping in R2 was €0.18, the respective figure was only €0.05 in the **UK** but as high as €0.56 in **Slovakia**. Using the median, which is less sensitive to outliers, the amount goes down to €0.15. Both values are considerably higher than the amount spent on action planning on average, which amounts to €0.06, with a median of €0.03. The values here range from €0.01 in **Bulgaria** and the **UK** at the bottom to €0.29 spent in **Germany**.

Within the sample of cost data / capita presented in the table above, **Germany** not only spent the highest amount on action planning in R2in absolute terms, but also in relation to its total population. Indeed, expenditure in Germany on action planning is higher than that of the MS with the lowest expenditure/ capita, **Bulgaria** and the **UK**, by a factor of 29. However, it should be noted that the level of costs is strongly correlated with the implementation approach. A contrast can be drawn here between the **UK** (specifically **England**) and **Germany**.

In addition to the above data, the national CAs in France and in Germany provided benchmark estimates of the costs of noise mapping for the population exposed to noise (affected inhabitants) and in relation to the costs of mapping for different sources. This additional information provides useful cost benchmark data and is presented below:

[144] Note – the per capita estimates are based on the total population using Eurostat figures (since the costs are incurred by each MS/ society as a whole whereas the benefits are accrued by the affected population).

Table 3.8 – Noise mapping costs in France

Source type	Average costs
SNMs for major roads	Average cost of noise mapping € 150 / km
SNMs within agglomerations	Average cost of € 0.75 / per capita.
NAPs within agglomerations	Average cost of € 0.84 / per capita.

Source: French national CA

Table 3.9 – Noise mapping costs in Germany

Mapping target	Round 1	
	Cost per affected resident	Overall cost
Agglomerations	0.64 €	0.19 € / resident
Major roads	2.58 €	272 € / km
Major railways	1.13 €	1077 € / km
Airports	0.91 €	304 € / km² area

Source: "LAI Erfahrungsbericht Stufe 1"

The only data directly comparable between the two countries shows that cost of noise mapping per affected inhabitant was slightly higher (€ 0.75) in France than in Germany (€ 0.64). The € 0.19 figure for mapping in German agglomerations in Round 1 can be compared to the figure of € 0.11 for noise mapping *overall* in Round 2 (see next table 3.), indicating a significant cost reduction between Rounds.

Both the French and the German figures show that the cost per capita (*affected* population) is considerably higher than the cost per capita (*total* population). This has been confirmed by figures provided by acoustics consultancies working in various Member States which are €1.50–€2.00 for software and hardware purchases by the Competent Authorities, and the activities of noise mapping, action planning and public consultations combined. This excludes the cost of noise abatement, mitigation and reduction measures. The cost of strategic noise mapping alone is estimated by industry experts to amount to €0.50-1.00 per *affected inhabitant*. The difference can be explained by the fact that these industry figures relate to *per capita (affected population only)*. It seems pertinent to focus on the *per capita (total population)* figures presented in the Table 3.7 earlier when assessing the administrative cost of END implementation. The reason is that the administrative cost of END implementation is ultimately incurred by the public sector as a whole, and thus by the tax payers and society in each country, whereas the benefits are only accrued by the *affected* population.

Assessment of administrative costs – detailed examples from the Member States

A more detailed assessment of administrative costs, and of differences between EU MS, is now provided. The focus is on the costs of both strategic noise mapping and action planning. No disaggregated data was made available on the costs (in terms of time) of providing reporting data and information to the EC.

Notwithstanding the various limitations and caveats relating to the cost data outlined in the section above on methodological challenges, a number of general trends can be observed based on an analysis of the administrative cost data provided by 23 EU MS.

The **costs of strategic noise mapping were lower in R2 than in R1** in at least several EU MS, despite an increase in the volume of noise mapping due to the transition to the definitive phase of END implementation from R2 onwards.

Typically, in the implementation of EU legislation, costs may be expected to diminish over time as those required to implement the legislation (and / or those subject to the legislation) become more familiar with the requirements and as MS implementation processes and procedures are developed and become embedded. In the case of the END, a key research issue explored was how far there appears to have been a reduction in costs between Rounds reflecting the absence of one-off costs in R2 relating to the activities specified in Article 1(1a, 1b and 1c) i.e. of strategic noise mapping, making information accessible and noise action planning respectively. There were found to have been reductions in costs due to economies of scale in the procurement of noise mapping and other technical services.

A reduction in costs was observed for instance in several MS (e.g. **BE, BG, CY, LT, LV** and the **UK**). Indeed, the costs of R2 noise mapping were sometimes less than half the equivalent incurred in R1. This was attributed to a number of factors, such as:

- Greater familiarity among CAs in procuring noise mapping services with the previous results of noise mapping.
- Strengthened ability among CAs to define their technical procurement needs leading to cost-savings.
- Greater competition among acoustics consultancies.
- General downwards pressure on noise mapping costs due to budgetary pressures linked to the aftermath of the economic and financial crisis.

Due caution is however needed in interpreting the evolution in cost data between Rounds in some EU MS. For instance, although the costs of noise mapping in the **UK** decreased by approximately four times between R1 and R2, this only partly explained by efficiency savings (e.g. learning from R1 implementation experience, the absence of one-off familiarisation costs). The main reason for the decline however was that there was a change in the approach to noise mapping between rounds, with greater centralisation of noise mapping (England only), which has led to economies of scale.

Conversely, in other EU MS (e.g. **DK, FR, LT, SK**), the costs actually increased between Rounds. Specific examples identified are that:

- In **Denmark**, the costs of noise mapping were only marginally higher in R2 than in R1 for agglomerations, but almost four times higher for major roads, reflecting the increase in the length of roads that have to be mapped.
- In **Slovakia**, there was a small increase in the costs of noise mapping from €2.65 million in R1 to €3.03 million in R2.
- In **France,** although no country-wide data was available for R2, the estimated costs of noise mapping at the level of agglomerations suggests that there has been a significant increase in costs between Rounds, due to the change in END thresholds.
- In **Lithuania**, the costs increased from €132,311 in R1 to €1,037,693 in R2. However, it was not possible to obtain complete data for the costs of R1 noise mapping, since the costs were not readily obtainable through public procurement databases, unlike for R2, where detailed data was provided.

In MS where there has been a cost increase between Rounds, this was generally attributed to the **significant increase in the volume of noise mapping required under the definitive END thresholds** applicable from R2 onwards. A detailed breakdown of the number of SNMs and NAPs required in R2 compared with R1 was provided in Section 2.3.7 and 2.3.8 as part of the second implementation review. This showed for instance a threefold increase in the number of agglomerations within scope.

In some EU MS, the budget originally committed was higher than that actually used. For example, in **Croatia,** the budget allocated for R2 noise mapping was €788,000 while only €564,000 was in fact spent. Conversely, the opposite was true in other cases. For example, in the state of Bavaria in **Germany,** the budget spent was €1,299,000 for noise mapping in R2 as opposed to an allocated budget of only €360,000. In **Poland,** the contrast was even starker (€125,000 allocated vs. €2,815,000 spent).

Expenditure on producing SNMs across MS exceeds expenditure on the development of NAPs. For example, in **Croatia,** the difference in R2 is € 564,000 for SNM vs. €119,000 for action planning. In **Denmark,** the difference in expenditure in R2 was €150,000 vs. €50,000. An exception is **Germany,** where the cost for noise mapping amounted to €9,200,000 in R2, as opposed to €23,500,000 for action planning. However, it should be emphasised that this relates to the costs of action planning processes (including organising public consultations) rather than to the costs of measure implementation, which although voluntary, is likely to be at least ten times the estimated administrative costs.

The **level of financial resources allocated to END implementation was found to vary significantly.** For example, in Germany, in R2, €9.2 million was spent on strategic noise mapping and €23.5 million on action planning. This contrasts with €2.82 million on developing SNMs in **Poland** in R2, and a much lower budget allocation in smaller MS (e.g. €170,905 for **Latvia**).

Human resources allocated to END implementation

Likewise, the **level of human resources allocated to END implementation was found to vary greatly between MS**, measured in terms of the estimated number of FTEs working on END implementation. The data was less complete than for financial resources, and sometimes only relate to the human resources available to national CAs, rather than to all CAs. As noted earlier, this is due to the difficulties experienced by national CAs in estimating the level of human resource inputs for all CAs and public authorities involved in END implementation.

Nevertheless, it can be observed that the level of human resources devoted to implementing the END at national level is quite low in many EU MS. Moreover, in several instances, resourcing was found to have been significantly reduced between rounds. For example, in **Lithuania**, whereas in R1, there was a small team of 3.5 FTEs working on the END at national level, there are only 1.25 FTEs working on the END, even though the volume of work has increased (for instance, END coverage has increased in R2, such that the number of agglomerations within the END threshold increased from 2 to 5).

In **Malta,** the number of FTEs working on the END was reduced from 1.25 FTEs in R1 to 0.1 FTEs in R2, although most of the work is being carried out by external consultants. In **Romania,** although no data estimates were provided, it was mentioned by an interviewee that there is only 1 FTE responsible for reviewing all the SNMs and NAPs produced across Romania and for reporting to the EC, which means that human resources are constrained. In **Portugal,** there was a reduction from 6.5 FTEs to 3.5 FTEs between Rounds, which was attributed to the budgetary crisis which also led to delays in getting noise mapping underway.

The reasons for the reduction in human resources were explored through the research, in particular through the interviews with national CAs. The research found that the reduction in human resources was partly due to the fact that there were no longer one-off familiarisation and upfront costs associated with the earlier stages of the END's implementation. Although there has been a reduction in human resources in some MS, it was pointed out by national CAs interviewed in some MS that during R1, more staff were needed to work on END implementation compared with R2, given the challenges of implementing the legislation for the first time (e.g. familiarisation with the information obligations under the Directive, additional time to define external technical assistance

needed to produce SNMs). A further factor was the economic and financial crisis, which had led to budgetary pressures in several EU MS that have affected staffing levels (e.g. **ES, PT and LT)**.

Moreover, the picture across EU-28 in terms of human resource levels was found to be quite varied, since in other EU MS, there was found to be a comparatively high level of human resources allocated to END implementation both in R1 and R2. However, direct comparisons between MS are difficult to make, since this depends on the overall approach to END implementation, and whether there have been any changes in this regard between Rounds. An important determinant of costs was whether the administrative system for implementing the Directive is centralised, decentralised or includes elements of both. For instance, in **Germany,** although there were estimated to be 196 FTE working on the END, a decentralised approach to END implementation has been adopted across 16 Länder at the state level. As noted earlier, Germany moreover has many different CAs involved in noise mapping and action planning at the local level for agglomerations. In **Finland,** an increase in resources at national level to the END was also noted, from 0.65 in R1 to 1.5 in R2.

The data collected suggests that overall, in many EU MS, there are **fewer public officials within CAs working on END implementation in R2 compared with R1**. Although the level of resourcing is entirely at the discretion of MS since the END is implemented under subsidiarity, as noted above, several instances of reductions in staffing levels devoted to END implementation were identified between R1 and R2. An issue was raised by interviewees from CAs in several EU MS as to whether sufficient resources are being made available for END implementation at national level. Some officials questioned whether this may risk undermining the effectiveness of END implementation in their MS in future rounds. In particular, if only one or two members of staff are involved, it was noted that there could potentially be challenges in retaining institutional memory. The concern was that if particular staff with END experience leave, then there will be problems in retaining sufficient knowledge and experience within CAs to ensure effective coordination and timely reporting of SNMs and NAPs to the EC at national level.

In EU MS that have adopted a decentralised approach to noise mapping and action planning as part of END implementation (Article 1(1)), such as **France** and **Germany**, the administrative costs were found to be relatively high in terms of the number of FTEs that are required to implement the END, especially in agglomerations. For instance, in France, although accurate data relating to the level of human resources involved was difficult for the CA to estimate, since the implementation approach involves producing a very large number of SNMs for agglomerations, it can reasonably be assumed that the human resource requirements in public administration are correspondingly high.

Other types of cost issues were also considered through the research, such as whether a comparison of the costs of undertaking strategic noise mapping in-house by CAs directly could be made with the costs of outsourcing the development of SNMs externally to acoustics and spatial data consultants.

Box 3.5 - The costs of producing SNMs in-house vs. externally

In most MS, the function of carrying out noise mapping has been carried out by external acoustics and spatial data consultants. It is therefore difficult to compare the costs of in-house and external solutions.

Limited data was however obtained from **Ireland** with regard to the costs of undertaking noise mapping internally. This showed that carrying out noise mapping internally was still quite costly, but probably cheaper than outsourcing the function (the cost was estimated as €300,000 in R1 and €400,000 in R2. This included both the one-off costs of purchasing software and IT equipment and the human resources needed to produce SNMs.

However, according to an interviewee from Dublin City Council, an advantage of carrying out noise mapping in-house was that in R2, Dublin City Council were able to provide support and guidance for the other new agglomeration in Ireland (Cork) in R2. In addition, the same local authority was able to produce all the noise maps required within the Dublin agglomeration on behalf of three other local authorities.

A key finding was that even when SNMs are produced in-house by CAs nominated as mapping bodies, there can be significant costs of producing SNMs (e.g. acquiring GIS data, the purchase of modelling software to calculate population exposure).

The evolution of administrative costs between END rounds

Through the research, the extent to which there were changes between R1 and R2 in the level of administrative costs was explored. A reduction in the level of administrative costs was identified between R1 and R2 in many, but not in all EU MS. The reasons for this cited by stakeholders interviewed were that:

- R1 was more costly, since there were **one-off costs** such as familiarisation with the legislation and the requirements for CAs, managing the procurement process and defining noise mapping needs in procurement procedures for the first time, and setting up MS-specific administrative systems and processes for data collection and information and reporting to the EC. In instances where SNMs have been produced in-house, examples of one-off costs identified were purchasing noise mapping software licenses and IT systems.
- In R2, there was **greater familiarity among CAs with the process** and the requirements involved in producing SNMs and NAPs, which led to some cost savings.
- However, there are also **recurring costs** in each noise mapping round, such as the procurement of external technical expertise to produce SNMs and other technical support from consultants. GIS data purchases are also likely to be recurring.
- There was an overall **increase in the number of CAs involved in END implementation in R2** due to the shift from the transitional to the definitive END thresholds between R1 and R2.
- Whilst an increase in the volume of mapping has led to increased costs, CAs involved in R1 have gained a lot of experience, and this has helped to keep the costs down. There was evidence that CAs involved in R1 shared their experiences with those that only became involved in END implementation for the first time in R2.
- The **economic and financial crisis has had an impact** in reducing noise mapping costs between Rounds. Since there was less budget available for SNM in many EU MS in R2, the level of costs has been reduced. Some MS faced particular budget constraints in R2 in procuring SNM services (e.g. ES, LV, LT and PT).
- It was noted in several MS in Central, Eastern and Southern Europe, that the **actual budget committed for noise mapping was often lower than the initial allocation**. This reflected strong competition in public procurement contests among acoustics consultancies. In Western Europe, there was also evidence of greater competition in R2 and of the maturation of the market.

EQ11b - What factors cause the greatest administrative burdens?

The extent to which CAs perceived there to be onerous administrative burdens associated with compliance with the END depended to a large extent on whether or not dedicated state budget had been made available to CAs especially for the purposes of commissioning SNMs.

The data presented above showed that **the *costs of strategic noise mapping* are low.** The estimated costs were based on cost benchmark data provided by national CAs and were accepted as being low in relation to the *costs per capita* among the *total*

population (see previous table, which indicated costs ranging from €0.05 to €0.56/ capita). The estimated costs per *affected inhabitant* based on data provided by acoustics consultancies during the course of the evaluation were also low, with the estimated costs ranging between €1.50 and €2.00, but this includes noise mapping, action planning and holding public consultations. Although these costs were considered to be low in absolute terms, **the extent to which SNMs are funded by central government has a significant influence as to how administratively burdensome** the costs of noise mapping and action planning are perceived to be among CAs and wider END stakeholders. This was particularly found to be the case at local level within agglomerations.

For instance, in **France** at local authority level, *communes* are not allocated specific budget from central government for noise mapping, but rather SNMs must be paid for out of a given commune's general budget. In R2, partly as a consequence of the lack of budget, only 20% of *communes* have approved and published SNMs (according to an interview with the national CA, as at mid-2015). Conversely, in relation to noise mapping of major roads and major railways in France, since in each *département,* there is a departmental representative from the State services with a dedicated budget for undertaking noise mapping, there have been no such delays. The fact that there are no implementation gaps in respect of SNMs for major roads in France, whereas there are significant gaps for agglomerations illustrates that the pace of END implementation is linked to whether MS have made the necessary dedicated budget available in the first place.

Although mapping costs per inhabitant in **France** were not seen as especially high, the number of CAs involved, and the focus on mapping very small administrative units was seen by some stakeholders interviewed as being fragmented and inefficient. For instance, it was pointed out that for the Paris agglomeration, rather than there being a single SNM covering the city (or dividing the city into a small number of different SNMs), each *commune* instead produces a separate SNM, which means that across Paris (and parts of the wider Ile de France region that are part of the wider Paris conurbation), there are 240 local authorities involved in producing separate SNMs.

In **Germany**, also, since noise mapping in respect of agglomerations takes place at a localised level of administration, this was cited as one of the reasons for the high levels of costs, due for instance to the requirement for many different local authorities designated as CAs to learn about noise mapping, the procuring of many, very small-scale SNMs which can lead to inefficiencies, and once the SNMs have been developed, a requirement for extensive coordination to produce a combined SNM.

In contrast, in the **UK** (**England)**, a dedicated budget was made available in both R1 and R2 for noise mapping in respect of the implementation of the END. However, since major airports are privately owned, a decision was taken that airport operators were required to pay their own costs. There have only been minor delays in the submission of all reporting information in the **UK,** which contrasts with the above example for **France,** where major delays and incomplete reporting submission can be discerned in the EC reporting databases.

A further finding was that the **administrative costs of noise mapping were found to significantly exceed the costs associated with noise action planning activities (i.e. under Art. 1(a) and Art. 1(c) respectively).** However, it is important to note that the data is somewhat misleading in that the costs of action planning presented in this sub-section to address EQ11 only take into account the administrative costs associated with the process of developing a NAP, as opposed to the substantive costs of measure implementation, which are more significant by a factor of 10:1 (these are presented in our assessment of EQ13, the CBA later in Section 3.2.4.3).

An issue raised in relation to perceptions of administrative costs is that there is a potential double layer of costs in that noise mapping is required for the END but further, more detailed noise mapping may be required depending on the prevailing national planning requirements in the MS concerned. Conversely, other stakeholders stated that whilst this might be an additional cost for the MS concerned, it **does not represent an additional layer of costs attributable to the Directive**. If the MS concerned has specific additional national requirements, this is the prerogative of the MS concerned since environmental noise policy is a national policy domain, and any such requirements are outside the scope of the END.

A further issue related to costs raised by a small number of interviewees was that when proposed mitigation measures identified in NAPs are being considered, then more detailed noise mapping and impact assessment is often required in order to justify the spending decision. Arguably, such costs do not relate to the END itself, but since the measures are often identified across other policy areas (e.g. transport planning, infrastructure development, land use planning) they depend on how extensive the culture of regulatory impact assessment is in the MS concerned.

Where **dedicated budget for noise mapping was made available**, there have been fewer delays and problems than in MS or regions where local authorities have been required to find the budget for noise mapping and they therefore had to identify resources out of their general budgets (where there are many competing budgetary priorities).

EQ11c – How far are the administrative costs of END implementation proportionate?

The extent to which the costs of END implementation are proportionate was examined through the analysis, taking into account the data collected on administrative costs and the findings from the assessment of this data, as presented above in EQ11a.

In order to assess this sub-EQ, it is first necessary to define in broad terms what is meant by "proportionate" costs. This relates to:

- Perceptions among END stakeholders at national level as to whether the costs of undertaking the activities required under Art 1(1)a-c (i.e. noise mapping, action planning, including public consultation) are proportionate.
- An assessment as to whether the administrative costs are proportionate relative to the ambitious objectives that the END is trying to achieve.
- An assessment as to whether the administrative costs are proportionate relative to the benefits

Assessing the first and second points was based on a combination of desk research and data collection on costs and interviews to obtain stakeholder views as to whether these can be considered to be reasonable. The extent to which the costs are proportionate to the benefits is examined through EQ13 (cost-benefit assessment). This focuses on the substantive compliance costs of implementing noise measures identified in NAPs as a proxy for efficiency, but also takes into account administrative costs.

It should first be recalled that the **costs are difficult to compare between EU MS due to the fact that different countries have adopted different implementation approaches** to noise mapping and action planning. This affects both the level of costs and perceptions as to whether the costs of implementing EU legislation are proportionate. For instance, the data presented earlier for France and Germany points to higher costs per capita and affected person in EU MS with decentralised implementation approaches (see tables 3.7 and 3.8). The interview feedback found that especially at local level, some CAs perceived the administrative costs to be quite high. For instance, in **Germany**, a decentralised approach was adopted to noise mapping and action planning

within agglomerations, with many different bodies involved in commissioning noise maps relating to small administrative units. There consequently appeared to be more limited scope to derive cost savings through economies of scale compared with MS that have adopted a more centralised approach to noise mapping, and / or that carry out mapping at a higher level of administrative unit.

In terms of whether the costs were seen as proportionate by END stakeholders, **most stakeholders interviewed viewed the costs as being reasonable**. The costs, *per capita* and *per affected inhabitant*, were generally viewed as low by END stakeholders. However, it was noted by some local authorities interviewed that when costs are assessed at the aggregate level, rather than per capita or per affected inhabitant, these can be seen as administratively burdensome by some public authorities, but this depends on the budgetary arrangements put in place by the particular Member State concerned.

It is important to distinguish here between **the actual costs and the perceptions as to whether these costs are high or low** (which is highly subjective among END stakeholders). The cost of noise mapping may be low in absolute terms, but a small municipality with limited budget for instance may perceive them to be high. For instance, in **France**, at municipality level, there is no dedicated state funding available for noise mapping within agglomerations, and the funding therefore has to come out of the general budget of *communes*. Similarly, in other EU MS, such as **Spain** and **Portugal**, although it was acknowledged that the per capita and costs per affected person) of noise mapping are low, in the context of the economic and financial crisis, there have been major funding constraints in R2. In other words, views on whether the administrative costs of END implementation are proportionate were found to be subject to change over time, depending on the prevailing situation in terms of public sector budgetary availability more generally.

A view among some NGOs was that the costs of strategic noise mapping, whilst low in per capita terms, can be significant in aggregate, especially when such mapping is carried out by local municipalities with limited resources. There was a concern that investing increased funding in noise mapping compared with the pre-existing situation might risk displacing funding that could otherwise have been used for noise mitigation, abatement and reduction measures. However, this was not borne out by the evidence. Since the average costs per inhabitant affected by noise of producing SNMs range from €0.05 (under a highly centralised approach to noise mapping) to €0.56, the research did not find evidence that this would make a significant difference to funding availability for measures to address noise at source at local level.

The evaluators also note that when assessing the proportionality of costs, it is important not to overlook the broader function of END data collection relating to the END's second objective, of ensuring that the necessary data is collected to that EU policy makers responsible for source legislation can make better informed decisions with regard to limit values at receiver in future. The interviews suggested that at least in some MS, CAs tend to perceive costs from the perspective of the utility of SNMs and population exposure data for their own country's perspective alone, and do not necessarily take into account in commenting on the costs of END implementation the fact that the data is used for EU policy-making.

Overall findings – administrative costs

Among the findings that can be drawn in relation to the assessment of cost data are that:

- The costs of strategic noise mapping were generally lower in R2 than R1. However, this was not the case in all MS, since some estimated that they had incurred additional costs in R2, due to the expansion in the scope of END coverage due to the transition to using the definitive END thresholds.

- There were found to be wide differences in costs between MS, reflecting the fact that the Directive is implemented under the subsidiarity principle, with varying approaches in terms of how noise mapping and action planning are carried out (e.g. centralised, decentralised, combination of the two).
- Significant variations in costs between EU MS were found to depend on further factors, such as population size and the geography of the MS concerned (e.g. which impacts on the length of the major roads and major railways network).
- More generally, different MS have allocated differing levels of human and financial resources to END implementation depending on the degree of political priority given to environmental noise in the MS concerned, how far the economic and financial crisis has curtailed the national, regional and local budget for END implementation, etc.
- At the level of the EU overall, in assessing administrative costs, efficiency cannot be assessed through a simple input-output relationship, since the relationship between administrative costs and outputs is not linear.

It is nevertheless helpful to have collected data on the (estimated) administrative costs of END implementation at national level since such data has never previously been collected. The data collection and analysis has been useful in the following ways:

- Although data hasn't been provided right across EU-28, there is a sufficiently representative sample of administrative costs data to develop cost-benchmark data (e.g. cost per capita, cost per affected inhabitant) that will be useful to inform EC policy development and future evaluation work.
- Administrative costs data has been fed into the CBA in order to assess the cost-effectiveness of measures, relative to the health and other benefits of the END.
- Administrative costs data would ideally have been more reliable and comparable. However, this would imply strengthening monitoring data to assess the evolution in the administrative costs of END implementation over time. Such data would be useful for MS national CAs (for benchmarking purposes) and for the EC (assessing the overall costs of the END vs. the benefits). This would be especially useful in facilitating future evaluation work to assess the full costs and benefits of the END.
- There is clearly a trade-off between the need to be able to evaluate what the Directive has achieved and monitoring the costs of its implementation, whilst at the same time ensuring that MS' administrative costs relating to reporting are proportionate.
- One possible solution might be to remind national CAs and their local and regional counterparts that periodically, evaluations will take place and they ought to retain some basic information and data about the approximate costs. This would then allow the evolution in costs over time to be better monitored and assessed.

Among the overall findings in relation to the proportionality of costs are that:

- Stakeholders generally acknowledged the costs of END implementation as being proportionate to the level of ambition of the END's objectives and not disproportionately burdensome.
- Stakeholders acknowledged that the *costs per capita* of strategic noise mapping are low both relative to the affected population and the total population. The average benchmark costs of noise mapping across a group of countries that provided costs data are €0.18 / capita (with a median of €0.15) and action planning costs of €0.06 / capita (and a median of 0.03). The costs per affected person (in areas within the scope of the END) were higher, but are also low.
- Although less robust data was available on the costs per capita for action planning (excluding measures), the costs of producing NAPs and holding public consultations, were also found to be low, and were broadly accepted as proportionate by stakeholders relative to the objectives of the END (and the scale of the societal and

health challenges).

- Some stakeholders were concerned as to whether the level of administrative costs was proportionate in countries where there were budgetary pressures linked to the economic and financial crisis. However, this was more due to a lack of funding available generally for environmental noise due to pressures within public budgets than noise mapping being seen as prohibitively costly.

3.2.4.3 The simplification of administrative requirements

EQ11d Can the Environmental Noise Directive overall, or the administrative requirements specified within the legal text be simplified?

Stakeholders were asked for their views as to how the END might be simplified.

There were only a few suggestions as to the possible **simplification of administrative requirements** within the Directive. This perhaps reflects the fact that there was a high level of acceptance of the core activities of the END relating to strategic noise mapping and collecting data on noise exposure and in respect of noise action planning. The following suggestions made were for instance:

- There may be scope for greater synergies (and ensuring greater consistency) between NAPs produced under the END and Air Quality Plans prepared through the Air Quality Directive. According to some stakeholders, this could potentially reduce costs or at the least, allow potential cost synergies to be further explored and if some are identified, exploited.
- However, the stakeholders concerned were unable to quantify the potential level of efficiency savings, since the suggestions as to how efficiency savings might be achieved were insufficiently detailed.
- A further means of simplifying the Directive would be to review the existing objectives and to consider making it clearer what the END's final objective is. This would then make it more feasible to identify, standardise and specify the data requirements that will be necessary to deliver on that objective.

Although there was not much feedback relating to the potential scope for simplification, suggestions were made by CAs and other interviewees with regard to how the legal text of the Directive could be improved to strengthen its coherence and the perceptions of a lack of clarity in some articles and sub-articles within the text.

Undertaking a review of the legal text in future could help to address minor inconsistencies in the text and would help to eliminate or reduce perceived ambiguities and further limit the scope for differing interpretations, thereby strengthening the efficiency of implementation.

Using the terminology associated with the Standard Cost Model[145], eliminating ambiguities has the potential to reduce the administrative costs associated with meeting particular administrative requirements in the Directive and information obligations linked to these. In the case of the END, this relates to the submission of reporting data on SNMs / population exposure and the submission of NAPs. Specific examples were provided earlier in the report of requirements and definitions that CAs found had created ambiguities or uncertainty (see the second implementation review, which includes an assessment of stakeholder views on the coherence of the Directive's legal text and also Section 3.2.2 - coherence).

[145] http://ec.europa.eu/smart-regulation/guidelines/tool_53_en.htm

For example, feedback from stakeholders suggests that there is a need to review and possibly clarify further certain definitions used in Art. 3 of the Directive (definitions), such as Art. 3(k) "agglomeration", Art. 3 (l) and Art. 3 (l) "quiet area within an agglomeration" and Art. 3 (m) "quiet area in an open area". The research also identified examples within the END where stakeholders perceive that further clarification is needed. For instance, there was an issue as to whether the formal requirement in the END is to draw up a NAP (Art. 8) or to adopt a NAP (Art 1(1c)). A further issue is the requirement in Art. 7(5) that "strategic noise maps shall be reviewed, and revised if necessary, at least every five years after the date of their preparation. The use of the terms "revised if necessary" was viewed as too ambiguous by several interviewees, who suggested that it was unclear what this actually meant in practice.

This requirement could relate to having to carry out noise mapping again subject to a certain level of change in the level of noise occurring between Rounds across the defined 5dB thresholds, or a change in the level of exposed population over the five year SNM cycle. Or it could simply be intended to be left to the discretion of the MS concerned under subsidiarity. This was also mentioned at the workshop by a small number of participants as an area needing further clarity.

Some CAs stated that providing further interpretation guidance as a supporting document to the Directive would help them to minimise the amount of time that they have spent since the Directive's adoption in interpreting what is meant by particular articles within the END. Some CAs commented that as a result of perceived ambiguities and uncertainties over the precise requirements, they had had to spend a lot of time discussing particular issues with stakeholders at national, regional and local level in their MS.

It was however difficult for stakeholders to quantify the magnitude of time savings of such simplification measures and clarifications as to the meaning of particular articles, sub-articles and definitions.

3.2.4.4 Efficiency of the END Reporting Mechanism

EQ12 - Is the END Reporting Mechanism efficient?

This EQ required an assessment of the efficiency of the END Reporting Mechanism ("ENDRM") and of the process of reporting by the EU MS to the EC, and the IT tools and shared information infrastructure available to MS CAs to provide reporting information to the EC. A summary of reporting and information requirements on END implementation is provided in the table on the following page.

Table 3.10 - Reporting by the Member States and the Commission under the END

Article 10 - Collection and publication of data by Member States and the Commission

- Art. 10(2) - the Member States shall ensure that the information from SNMs and summaries of the action plans as referred to in Annex VI are sent to the Commission within six months of the dates laid down in Articles 7 and 8 respectively.
- Art. 10(3) - the Commission shall set up a database of information on strategic noise maps in order to facilitate the compilation of the report referred to in Article 11 and other technical and informative work.
- Art. 10(4) - every five years, the Commission shall publish a summary report of data from strategic noise maps and action plans. The first report shall be submitted by 18 July 2009.

Article 11 - Review and reporting

- No later than 18 July 2009, the Commission shall submit to the European Parliament and the Council a report on the implementation of this Directive (and every five years thereafter).

Note – the first implementation report was actually finalised in 2010 and published in 2011. The second implementation report is scheduled to be published in 2016.

Reporting on END implementation at EU level is clearly dependent on the smooth and efficient transfer of data and information to the EC. In order to ensure data comparability, the way data is submitted by MS to the EC should be as consistent as possible. The EC is supported in carrying out the collection of reporting data by the EEA, to whom specific tasks have been delegated. In order to ensure data comparability, the way data is submitted by MS to the EC should be as consistent as possible. The focus was therefore on assessing how efficient the current IT system and associated online data completion processes within Reportnet are relating to the transmission of noise data and information by MS CAs to the EC.

The focus of the analysis in this section is therefore not on other reporting-related issues that are important from an effectiveness perspective, such as the timing of reporting and outstanding data gaps in the EC databases (see Sections 2.3.7 and 2.3.8 in the second implementation report), the quality and utility of the data reported by MS and the way in which the data has been used and reported by the EC (see EQ7a, Section 3.2.3 under effectiveness and Appendix G, outstanding challenges in implementing the revised Annex II). These crucial issues are addressed elsewhere in the report as per the section references above. The linkages between the efficiency and effectiveness of the ENDRM should be noted.

Introduction – the END Reporting Mechanism ("ENDRM")

Prior to analysing feedback from national CAs in relation to this EQ, it is important to provide an overview of the way in which the ENDRM operates, and the different possibilities in respect of the submission of SNMs and NAPs under the reporting mechanism.

Table 3.11 END requirements and END reporting mechanisms

Aspect of the END Reporting Mechanism (ENDRM)	Description
EIONET https://www.eionet.europa.eu/	The EIONET is a partnership network set up by the EEA, consisting of National Focal Points in each MS across EU-28 and the EEA cooperating MS (5). EIONET is used as a mechanism to collect different types of environmental information, including reporting noise data and information under the END. Whereas formally the END's scope applies across EU-28, the EEA's Eionet extends to a wider grouping of 33 countries (including EU-28 and 5 cooperating countries). All EU-28 MS must report on the data required in the END. However, in addition, any EEA Member Countries and cooperating countries that are not EU members can report on a voluntary basis.
Reportnet http://www.eionet.europa.eu/menureportnet	Reportnet is a reporting platform and EEA information system for the electronic submission of data and information. Although Reportnet was set up by the EEA for other environmental reporting purposes[146], it has subsequently been adapted and tailored for electronic noise data reporting purposes under the END. The EC has formally stated a preference for the use of Reportnet in the delivery of data relating to Directive 2002/49/EC. In order to satisfy the reporting obligations, a letter of confirmation must also be sent by the MS' Permanent Representation to the Secretariat General of the Commission stating that the upload to Reportnet has taken place. The data delivered through Reportnet feeds into a relational database that collates data through the Reportnet and other submission mechanisms allowed under the ENDRM (such as by email and even submitting SNMs / NAPs in hard copy should they so choose). It is recommended, but not obligatory, that MS should report data and information through Reportnet.
The END databases of SNMs and NAPs http://cdr.eionet.europa.eu	Two relational databases were developed in Excel in 2007 to collate reporting information and data on SNMs and NAP summaries submitted by the MS. The ENDRM database has been designed as a relational database for data delivered through Reportnet. Data uploaded into Reportnet feeds into the Central Data Repository ("CDR"), which contains the two relational databases.
Alternative mechanisms for submitting reporting END data and information	There are a number of different mechanisms for MS CAs to submit reporting data and information to the EC. MS can either submit via the Reportnet electronic data transmission system, the EIONET, or alternatively, directly to the EC via email with SNMs and summaries of NAPs attached.

Reportnet is linked to the EIONET network of MS authorities that is involved in wider environmental reporting activities. Reportnet is part of an integrated approach to environmental reporting, since national CAs responsible for other EU environmental Directives also use the Reportnet in order to meet their reporting obligations under other Directives.

The way in which specific reporting mechanisms to meet the requirements of the END under Art. 7(1) (Strategic noise mapping) and Art. 8(1) (Action plans) are now described in the following table. Since the timings of the reporting procedures and data flows differ, it is important to explain how the reporting procedure and quality review process differs for SNMs and NAPs:

[146] Reportnet provides an existing framework for the reporting of environmental data flows, such as those required by relevant air quality and water framework directives and through the END.

Table 3.12 - END requirements and how this relates to the ENDRM

END requirement	Reporting procedure and quality review
Strategic Noise Maps (SNMs) **Article 7(1) Strategic noise mapping**	SNMs are usually submitted via the Reportnet system. An official notification is sent to the EC indicating when MS have delivered SNMs. Population exposure data submitted via Reportnet is initially analysed for administrative compliance purposes by the EEA on behalf of the EC. The content of the data is then analysed to produce an EU-level assessment of the 'quality of the acoustic situation in the EU' as required in Art. 11(3), through the Noise in Europe report. Data and information on SNMs and in respect of population exposure is disseminated via the Noiseviewer (http://noise.eionet.europa.eu/) which is administered by the Noise Observation and Information Service for Europe maintained by the EEA and the European Topic Centre for Air Pollution and Climate Change Mitigation (ETC-ACM) on behalf of the EC. The latest information available in the Noise Viewer has been quality-checked by the EEA. This includes population exposure data and noise contour data and maps.
Noise Action Plans (NAPs) **Article 8(1) Action plans**	An official notification is sent by the EEA to the EC indicating the timescale when MS have delivered NAPs. Through the CDR within the Reportnet system, a record of the NAP summaries that have been submitted is collated. The EC analyses data completeness in respect of NAPs.

Summary of Division of Administrative responsibilities

In order to assess the efficiency of the Reporting Mechanism, it is necessary to describe how the ENDRM works and the shared IT infrastructure that supports it, but also the **division of administrative responsibilities for collating reporting data through the ENDRM.** As noted earlier, the EC is formally responsible for the collation of END reporting data under Art. 10 and for reporting on this data in five yearly reports (Art. 11). Since 2005, the EC has in practice delegated certain tasks relating to the collation of END reporting data to fulfil the requirement set out in these articles to the EEA. Accordingly, the EEA was responsible for the development of templates for MS CAs as to how to complete reporting information and for the development of guidelines as to how to submit information on SNMs and summaries of NAPs via the Reportnet, and how to access the **Central Data Repository** ("CDR"). The EEA is supported by an independent contractor with regard to data completeness and compliance verification.

The EEA undertakes a quality-check in respect of SNMs and population exposure data submitted by MS CAs in order to ensure that the data complies with the Directive's requirements, and that SNMs meet minimum quality standards. An internal manual has been developed setting out the internal rules for undertaking a quality check of SNMs and population exposure data to ensure coherence and consistency between the data and information delivered by each EU MS. The EEA also deals with the spatial data submitted (noise contour maps and the location of noise sources).

It is important to describe how the ENDRM has evolved since the first reporting deliverables had to be reported by EU MS from 2005 onwards[147]. The operational aspects of the ENDRM – and the IT infrastructure to support END data and information submission - have been developed over time. For instance, internal procedures were developed for checking the quality of data (see the above description under 'administrative responsibilities'), dataflows relating to the ENDRM have been clearly defined and templates have been developed, initially in 2006 through a consultancy

[147] In 2005, the information collated related to informing the EC about which sources would be mapped, and subsequently, data in respect of R1 SNMs and NAPs was collected in 2007 and 2008 respectively.

project and subsequently updated in 2011 by the EEA. It should be noted that the focus is on describing the Reportnet system, since this is the Reporting Mechanism that the EC formally recommends and most MS CAs use.

In 2012, the EEA published a *Handbook for delivery of data in accordance with Directive 2002/49/EC*[148]. This provides a description of the Reportnet Electronic Noise Data Reporting Mechanism, summarises the END reporting obligations relating to particular articles and sub-articles and outlines the structure of the data flows. Examples of schema templates for national CAs, and a description of how the ENDRM feeds directly into the CDR database in order to aggregate data submitted by the MS are also provided. In the handbook, the EEA has developed a number of different schemas and templates for reporting in different formats to capture the main data and information from the processes of strategic noise mapping and action planning. These include:

- Tabular data in xml, spreadsheets (Microsoft Excel) and/or databases;
- Geographic information;
- Web forms and written reports;
- Metadata.

The EEA Handbook states that *"where appropriate, data formats and specifications for the ENDRM templates have been harmonised with those of existing environmental reporting obligations reported through Reportnet".*

The arrangements for the **uploading of data and information through the ENDRM and its subsequent transmission to the EC** are now set out. In order to facilitate the uploading of data through Reportnet, there are two levels of predefined folders. The first level (under EU obligations) is entitled 'Environmental Noise Directive'. In the second level, there is a folder relating to each data flow (e.g. SNMs, NAPs). Summaries of NAPs are also collected through the Reportnet system.

Based on the data provided through the Eionet on SNMs and NAPs, the first Noise in Europe Report[149] was published by the EEA in 2014. NAPs submitted through Reportnet are compiled by the EEA and a process has been developed that focuses mainly on checking compliance (e.g. with the minimum requirements set out in Annex V). The QC results are reported to the EC.

Data completeness is currently checked by the EEA against the END requirements and takes into consideration as far as possible how the data has been submitted. This is especially relevant for major roads and major railways, where **MS report quite differently depending on how they have chosen to carry out strategic noise mapping**. The geographic scope of coverage varies significantly. Taking major roads as an example, MS report differently, some on entire road networks, whilst others on multiple and / or individual road segments.

There are two ways that MS report data on population exposure for major roads and major railways:

- **Per segment** - then any missing segments can be identified by comparing these to the sources declared on which MS intend to report.
- **Per reporting entity -** this corresponds to a country or a region (depending on how the country decided to report the data). In such cases, this is a single value and is assumed to cover all the segments declared as noise sources.

[148] Technical Report for an Electronic Noise Data Reporting Mechanism http://www.eea.europa.eu/publications/noise-handbook/at_download/file

[149] http://www.eea.europa.eu/publications/noise-in-europe-2014

The EEA takes into account the percentage of inhabitants covered in the data completeness statistics wherever possible (i.e. for agglomerations).

Data and reporting information outputs

The **data and reporting information outputs** collected by the EEA on behalf of the EC for END reporting purposes are summarised in the box below. This includes not only END data and information, but a number of other areas of information and data collection that help to monitor the Directive's implementation. These provide information relevant to five yearly reporting on implementation, and include:

Box 3.6 - Outputs from the ENDRM at EU level

- Noise Directive DF0: Definition of reporting structure
- Noise Directive DF1_DF5: Report on all major roads, major railways, airports and agglomerations
- Noise Directive DF2: Competent bodies
- Noise Directive DF3: Limit values in force report
- Noise Directive DF4_DF8: Strategic noise maps report
- Noise Directive DF6_DF9: Noise control programmes
- Noise Directive DF7_DF10: Action plan summaries

Reference should also be made to Section 2.3.7 (SNMs) and 2.3.8, which makes extensive use of the data contained in DF4_DF8 and DF7_DF10 respectively.

Data and information on the latest reporting position in respect of data completeness pf SNMs is periodically made available online by the EEA in Excel form. Noise mapping results collected by the EEA through Reportnet are published online on the Eionet website using the **Noiseviewer tool** since 2009 (noise.eionet.europa.eu/), which is used as a mechanism for the dissemination of data and information on population exposure. The above deliverables are also crucial for END reporting at EU level, in particular for the EC, which is responsible for reporting on the Directive's implementation once every five years.

All reporting information submitted by MS corresponding to NAPs for R1 and R2 submitted by 30/06/2015 were compiled and can be reviewed in the Access database published. In the case of R1, it consists of the links in Reportnet where the information is submitted, and for R2, all the information submitted through the web forms and have been compiled in table form. Coverage files are also available.

Desk research to assess the efficiency of the ENDRM

As part of the evaluation, an assessment has been carried out of the ENDRM which has focused on the Reportnet online reporting tool since this is the primary transmission mechanism for submitting reporting data and information. The EEA Handbook on the END reporting tool was also reviewed, as well as visualisations of the different reporting templates. In addition, the Excel databases themselves have been reviewed by our team and used during the study, for instance, to assess data and information completeness in respect of SNMs and NAPs (see Section 2.3.7 and 2.3.8) and to ascertain the extent of availability of data and information on the estimated costs and benefits of measures implemented which were used to select case studies for the CBA (see Appendix F for the case studies). Reference should also be made here to some of the weaknesses in the coherence of the data being collected, especially on agglomerations, which are examined under the effectiveness section (see the sub-heading on the "quality of data" EQ7a Section 3.2.3.2).

The desk research and interviews found that among the **advantages of the Reportnet adapted** for electronic reporting purposes for the END are that:

- Reportnet is based on a common EU-wide reporting and information system, supported by common templates, which is necessary to collect information and data on a common basis, which is essential for meeting the second objective of the END (Art. 1(2)).
- The use of Reportnet by most MS under the END helps to promote an integrated approach to environmental reporting, since national authorities are using Reportnet as the reporting system to submit data and information to the EC in respect of other environmental Directives. For instance, national CAs can use their Eionet username in order to access the CDR within the Reportnet. Using the same system to report on different Directives is more efficient than developing different IT systems for different Directives.
- The use of Reportnet by the majority of MS since 2009 has helped to strengthen the efficiency of END reporting, since there would be inefficiencies if MS used different methods of submitting SNMs and NAPs (e.g. due to the need for manual data entry).
- The reporting system is transparent. The fact that there is a shared information infrastructure across MS means that once uploaded, the data is directly linked to the CDR.
- The principles set out in the EEA handbook, such as those relating to the use of relational database principles in structuring the electronic mechanism for END reporting are sound.
- The Central Data Repository (CDR) is able to update reporting information in real-time, and also has the capability to aggregate information from across EU-28. Setting up the database to do this automatically has been time saving.

In the early stages of END implementation, it was common for different MS to submit reporting data and information through different mechanisms, not only **Reportnet, but also the EIONET** or **directly to the EC via email and even in hard copy**. Since 2009, however, the EEA has recommended that MS should transmit reporting data and information electronically through a single mechanism, the Reportnet portal, which is based on a **shared information infrastructure.** However, MS may also submit completed SNMs and NAPs through another mechanism if they so wish. Members of the EIONET have common access to Reportnet. Following the submission of END data delivery by individual MS using a country code, this data is linked to the **Central Data Repository ("CDR"),** which collects all the data and information submitted by MS to provide.

The complete picture in terms of the preferred Reporting Mechanism that particular MS are currently using was difficult to ascertain across all EU-28, since **some MS have not yet submitted SNMs and NAPs in R2**. According to a an online survey response by a relevant stakeholder, **Reportnet has been used by the majority, but not all Member States to report requested END data**. The evaluation team was not able to interview either the EEA or the EC (due to concerns about avoiding bias during the evaluation process) to check the principle delivery mode, but our understanding from the interview programme is that the Reportnet has been used more frequently than other delivery mechanisms.

The EEA handbook emphasises a number of common sense principles that ought to strengthen the reducing repetition through the **use of relational database principles.** These include:

- Adopting formats which best suit the type of information to be reported;
- Ensuring consistency of reporting formats between successive reporting rounds;
- Adopting formats which are in line with existing EEA/EC reporting approaches.

The evaluators found that **these principles are sound and have helped to maximise the efficiency of the Reporting Mechanism**. They are important in avoiding unnecessary repetition and / or inconsistency in data and information reporting processes and procedures.

The two databases that collate reporting data and information submitted by the MS to the EC were developed in Excel. MS are able to enter data in a more complex relational spreadsheet if they so wish using Reportnet. The possibility of using Access was raised by an EC official as the number of data points in the two END databases within the CDR increases, it may be more efficient to transfer the END reporting databases from Excel into an Access database. However, whilst Access is a useful tool for managing large contacts databases and for storing qualitative information (such as NAP summaries), Excel is better for storing large quantitative datasets on SNMs and population exposure data. The data can also easily be analysed using other statistical software. A further supporting factor for not changing the format is that MS submit in Excel and Word templates which was purposely designed to be compatible with the software that MS most commonly use. In our view, the **use of Excel is 'fit for purpose'.**

Moreover, whilst Excel can be used to store the data and information, it can be analysed in any software format by the EU (assisted by the EEA). Some data and qualitative information is already being stored in Access, such as NAP summaries by the contractor assisting the EEA.

The ability to load information by different informational levels by country appears to be an efficient way to structure the data and information.

The research found that the ENDRM is generally efficient, but that **there are also some drawbacks and disadvantages of the Reporting Mechanism** as it currently operates. According to the research:

- There is presently no collection of measure-level data on the implementation information / updating of the ex-ante cost data projections presented in NAPs.
- Some of the graphs in the Handbook on data models can't be easily read since they are of low resolution. However, MS CAs ought to have access to the original graphs and templates directly through the Reportnet.
- A further issue relates to the extraction of EU-level synthesis data and information through the database. In the course of this evaluation, the evaluators have found that although it is possible to obtain an EU-level overview of data completeness in respect of SNMs relatively easily, it is more difficult to extract information on data completeness on NAPs.
- The requirement to **submit a letter from the Permanent Representation to inform the EC of the formal delivery of SNMs and NAPs seemed overly bureaucratic** to some END stakeholders. If the electronic END reporting and information system works efficiently, it could be reconfigured to provide automatically generated emails informing that particular data has been uploaded. However, balanced against this, whilst in an ideal world, most data would be submitted for the same MS and the same source at the same time, in practice, SNMs and NAPs are often completed at different times and are therefore often uploaded into the system in different time periods.

- In MS that have adopted a decentralised approach and / or those in which MS have decided to produce many SNMs and NAPs relating to smaller administrative units (e.g. DE, FR, NL), it has proven more difficult to synchronise the submission of reporting data and information. This may make it more difficult for the EC to gain an overview of the latest position on reporting completeness, since reporting information and data is more likely than under a more centralised system to be submitted at different points in time. The involvement of the Permanent Representation in the formal

submission process appears to be an unnecessary additional step since END reporting information and data should already be available to the EC in the database in real time. This requires coordination between the Permanent Representation and the national CA on each occasion that SNMs and data and NAP summaries are uploaded.

Feedback on the ENDRM from interviewees

A number of issues were identified in relation to the ENDRM through the interview research.

Overall, Reportnet was viewed as being a reasonably efficient mechanism for the submission of reporting data. However, there were aspects of the mechanism that it was felt could be improved, such as:

- The need to strengthen the user-friendliness of the reporting mechanism;
- The need to streamline and/ or simplify reporting procedures;
- The problem that it can take a lot of time and resources to upload END reporting information, especially summaries of action plans since there are many different data fields and the civil servant uploading data must familiarise themselves with the data codes.

The above issues are now explored in further detail.

The ENDRM was seen as not being sufficiently user-friendly by national CAs in several EU MS. For instance:

- A CA from **Cyprus** regarded the ENDRM as not particularly user-friendly due to the amount and type of information to be entered. The Department of Environment expressed the interest to attend some training sessions to be organised by the EEA.
- A CA in **Denmark** did not regard it as very user-friendly either and noted that staff changes at national level within CAs can makes it harder to understand the technical functionality of the EIONET and Reportnet, undermining continuity of the ENDRM from a MS perspective.
- A CA in **Portugal** commented that the ENDRM is not very user-friendly because it has got many requirements in terms of codes, such as codes for road sections and file codes, and the codes have changed over time, for instance in the Guide on the use of the ENDRM issued by the EEA.
- The lack of user-friendliness was also pointed out by an **Estonian** CA who stated that it was not clear to them what kind of information they were expected to report and who indicated that they received feedback on being non-compliant even though they had entered data using the ENDRM.
- Similarly, a stakeholder in **France** was not clear about what kind of information was expected under the ENDRM and claimed that the understanding of this varied between Member States.
- Some CAs were unclear as to whether the complete NAP or only the summary had to be submitted to the EC. Although the Directive is clear in this regard that only the summary is required for reporting purposes, there were concerns that MS may produce and submit a summary of the NAP before the complete NAP has been finalised or adopted at MS level. This could undermine the efficiency and effectiveness of reporting since the data would not be as reliable as presumed.
- Part of the confusion may arise because the content of complete R2 NAPs (and the summaries, where available) that were available by 2013 were taken into account by the EEA when data for the Noise in Europe Report was compiled.

Further feedback is now examined. It was regarded as being **overly time consuming to submit some END reporting information.** For instance, in the UK, the national CA for England commented that action plan summaries can be extremely time-consuming to complete. "Separate web fields need to be completed online for each area of required information – England alone has 65 agglomerations, which means that almost 1000 fields have to be completed. Some suggestions were also made as to how the transmission of reporting data and information might be further improved by the same CA in a consultation response to the EC's Open Public Consultation (OPC) on the END. These are set out in EQ20, which highlights suggestions made to help simplify the reporting mechanism.

Some positive feedback about the ENDRM was also received. For instance, in **Spain,** a CA commented that the ENDRM is a good system because data is provided in the same format across the EU. It was also noted by the Spanish CA that the reporting system has been improved over time. It was however stated that there remain some problems with the reporting system in that mapping units that use the same code produce an error code.

With regard to the availability of guidance, the **Finnish** and **Hungarian** CAs stated that guidance provided by the EEA and EC on reporting was sufficient and that they had no issues with the Reporting Mechanism itself. However, the CA in **Cyprus** pointed to a need for training.

The national CA in **Romania** stated that it had taken them a very long time to upload the data and information required for reporting purposes and also to check the data first produced by external consultants before uploading the data. However, the general perception was that the amount of time to submit END reporting data and information to the EC was proportionate. The challenge is not the time to upload and submit the data, but the process leading to the production of the SNMs, population exposure and NAPs in the first place.

An END stakeholder who has worked on the Eionet reporting system noted that *"since the END is concerned with data and information flows, information should be better linked so that it adds value to the END process. The reporting of END data should create relational databases rather than only statistical tables".* However, the EEA notes in its handbook that the two databases in respect of SNMs and NAPs are relational and this was confirmed by another interviewee. However, some MS have only been completing the basic excel template and not the more advanced excel sheets that are relational. There was some feedback from stakeholders that the databases would be more efficient and effective if they were fully relational.

Some MS expressed the view that the information and data requested by the EEA sometimes appeared to be more detailed than was stipulated in the Directive. An important observation was made by the authorities in the **UK** in relation to reporting requirements more generally. The CA with overall END reporting responsibility stated that it wasn't always clear whether reporting requirements under the END correspond only to the END's legal obligations. It was suggested that "Reporting should directly relate to the legal requirements of the Directive and the links to the legal requirements should be made clearer". A further concern in the UK was that "Guidance or voluntary reporting are sometimes expected of MSs in the same way as mandatory information". The national CA in the **Netherlands** also maintained that the reporting requirements under the mechanism itself are more detailed than the reporting obligations that can be derived from the Directive itself.

In the view of one interviewee involved in the ENDRM, however, the request for more detailed reporting information from MS is perhaps not surprising, however, given that the Directive summarises the types of information and data that needs to be submitted and associated timelines, whereas the EEA Handbook on Reporting translates these broader requirements into more detailed operational guidance relating to Data Flows.

A further important issue raised was that although the database provides a "real-time" snapshot of data completeness, the research found that information on data completeness is somewhat partial due to the lack of timely and standardised reporting by all EU-28 MS. The Central Data Repository database generates information on the total number of SNMs submitted only, but not on the percentage population already covered. This makes it difficult for the EC to produce and obtain an accurate picture in respect of data completeness. This issue could be addressed by the MS directly by ensuring that they report on time by the due submission dates, although it could also help to standardise END reporting approaches in future.

An example where MS supposedly reported at a more detailed level than required by the END was that Annex VI requires the number of persons exposed by 5dB threshold to be quantified rounded to the nearest hundred. In practice, however, some MS report on the precise number of inhabitants and this was perceived by a few stakeholders as going beyond the concept of a strategic approach to noise mapping. However, it was clarified that this was based on a misunderstanding of the requirements and in fact, exposure data to the nearest hundred is acceptable for END reporting purposes.

In terms of the *type of information* required to be submitted, an interviewee that has worked on the END reporting system commented that the current reporting for SNMs does neither require MS to provide exposure data for major roads and major railways by km of coverage within END scope, nor at segment level. Rather, it only requires data at the country level – although some MS still provide completeness at segment level on a voluntary basis (for further information, see section 2.3.7). In practice, the EEA assumes that data for major roads and railways correspond to the whole country and is thus complete wherever MS submitted *some* data for their countries.

An important piece of feedback received in **relation to ways in which the databases linked to the ENDRM could be improved in terms of the types of data being collected** was as follows. "Mapping agglomerations and major sources results in arbitrary inclusion of EU citizens. The agglomeration 'receptor' assessment and major source 'source apportionment' assessment are also different types of assessment – the results of which have different definitions and should be interpreted separately. To solve this assessment complexity and to include all citizens, one approach might be to map the whole country in detail, and to extract from that the data required to be reported to Europe. By extension, another approach could be to map the whole of Europe in detail and extract from that dataset whatever data the Commission or a particular MS might require for their own particular purposes".

A further aspect of END reporting that received comments from several national CAs was the **timing of reporting requirements**. Currently, there is a requirement to inform the EC as to **which major noise sources are going to be measured and reported on 2 years ahead**. For instance, in R2, the notification had to be made by 30/06/2010, whilst the deadline for finalising noise maps was 30/06/2012. EU MS then have 6 further months during which they must report the noise mapping results to the EC, which means that the official deadline for submitting SNM for R2 is 31/12/2012.

The concern from a reporting perspective among some MS stakeholders was that there could be changes in the intervening period meaning that what is actually reported may differ from what was originally meant to be reported, and that this could be interpreted as non-compliance. However, the EC made clear that they always take such factors into account when assessing the completeness of reporting information.

An issue raised by some END stakeholders was that MS have to provide reporting data to the EEA on SNMs by a specific cut-off date which could lead to a misleading picture of the completeness of reporting information on the implementation situation across EU-28. The concern was that since many MS have encountered difficulties in meeting the 12 month deadline between the submission of SNMs and NAPs, there is a risk that some MS will miss the cut-off dates for data analysis. This means that the data may show

considerable outstanding implementation gaps, but at least some of those MS may be very close to completing the mapping process and to submitting data.

However, the EEA noted that collecting population exposure data is necessary for EU-level END reporting purposes, such as informing the preparation of the technical reports on the first and second implementation reports of the END and the Noise in Europe report, 2014. Since 2007, there has been a cut-off date agreed annually. The dates are set were well after the legal reporting deadline stipulated in the Directive. The EEA produces annual updates of END reporting information, in order that they have an overview of the state of play in implementation at European level. There has accordingly been a cut-off date every year. For instance, in the case of the information included in the Noise in Europe Report, this was 8 months after the formal deadline by which time MS should have reported to the EC. The most recent cut-off dates from when R2 SNM were meant to be available are 28 August 2013, 10 June 2014 and 30 June 2015. Moreover, in recognition of the fact that some MS have been very late in their reporting submissions, data completeness of SNMs has been analysed in R2 one year after the original cut-off date so that a more up to date picture could be obtained.

Another issue raised by many stakeholders related to the **timeframes for reporting**, which effects both the efficiency and effectiveness of the overall reporting system. A number of EU MS stated that the deadlines for the submission of reporting data and information in respect of action plans is unrealistic (12 months after the submission of SNMs) to allow time for action planning processes (including public consultation).

Lastly, it should be noted that following the transmission of END data, it is important that the **data is scrutinised from a quality and utility perspective**. One stakeholder closely involved in the mechanism commented that "Reportnet data tends to be analysed from the point of view of compliance rather than for its content and value". Reference should be made here to the section on effectiveness, which examines the utility of END reporting data under EQ7a.

Challenges in the collation and coordination of data collection at national level

Although not part of the ENDRM itself, the data available in the database at any particular cut-off point in time is clearly strongly impacted by any delays in producing SNMs and NAPs and also by challenges in collating data at national level. Issues relating to delays in the submission of SNMs and NAPs are explored in detail in Sections 2.3.7 and 2.3.8.

Some stakeholders pointed to difficulties in **ensuring effective coordination in data collection at MS level.** These were seen as having contributed to delays in the timely submission of reporting information and data to the EC. Since the Directive does not set out reporting obligations at sub-national level, some national CAs (e.g. Denmark, France and the Netherlands), perceived that they did not have sufficient enforcement powers under the END to compel local authorities to provide the necessary reporting information and data needed at national level in order to report to the EC (SNMs) and the EC (NAPs) on time even if those administrative bodies had been designated within the national implementation system as CAs. This has led to additional delays in the submission of a complete set of national reporting data to the EC.

However, the EC responded that since the END is implemented under subsidiarity, it is the responsibility of Member States to develop their own administrative arrangements, including arrangements for meeting their reporting obligations/.

Simplification of reporting requirements

A number of suggestions were received as to how the reporting process could be made simpler and less onerous. These are set out in our response to EQ20 (How could the ENDRM be made more efficient?). Key findings – efficiency of the ENDRM

- Although the majority of MS are already using the Reportnet system, the efficiency of the collation of END reporting data could be improved if all EU MS were to use Reportnet (since the shared information system is linked to the CDR which automatically enters data in a way that can be aggregated.
- Most national CAs were satisfied with the guidelines produced by the EEA as to how to use the Reportnet[150] system.
- There was however feedback from many EU MS that the user-friendliness of Reportnet needs to be further improved, with some indications that the information requirements are not always sufficiently clear.
- However, not all stakeholders agreed. Some national CAs stated that the ENDRM was relatively easy to use and to upload the END reporting data and information.
- Reportnet has been efficient in enabling the EC to report on its monitoring and reporting obligations under Art. 11 and in developing an electronic database of information on SNMs, as required under Art. 10 (3). However, there are aspects of data capture, especially in relation to agglomerations, that need to be strengthened.
- The requirement to send a letter to the Permanent Representation appears to be an unnecessary additional step in the process that makes it less efficient, but eliminating this step would require automatic email alerts to be set up to inform the EC about data and information submissions by a particular national CA.
- Steps clearly need to be taken to ensure more timely reporting *(see effectiveness)* since having an efficient reporting system without sufficiently comprehensive data in it undermines the efficient and effective implementation of the Directive.
- However, this cannot be achieved in isolation from the need to consider whether the current timescales stipulated for reporting data and information through the ENDRM for NAPs in particular is appropriate, given that in the second implementation review, many stakeholders stated that the timeframe of 12 months between the submission of SNMs and NAPs was unrealistic.

[150] http://www.eionet.europa.eu/reportnet - Data Exchange Modules (DEMs) are used to collect and validate data delivered by the countries. Most DEMs are Excel templates that are converted to XML by CDR. Others are completed in online webforms.

3.2.4.5 *Measure-level assessment of costs and benefits*

It is possible to conduct a methodologically robust EU-wide CBA of the implementation of the END, but not a precise one at the present time. This is largely because many of the measures identified in Noise Action Plans (NAPs) have either not yet been implemented or were already underway before the NAPs were produced and thus cannot necessarily be attributed to the END. A more detailed discussion of the approach to, and limitations of, the CBA is presented in Section 3.2.4.5 and in Appendix D.

It is also possible to derive a very broad indication of the relative costs and benefits of implementation of the END for typical measures (or packages of measures) relevant to agglomerations and major roads, major rail and airport infrastructure in such a way that also satisfies the requirements of Art. 11 (3) Review and Reporting of the END which states that "*the report shall include a review of the acoustic environment quality in the Community. […] The reduction of harmful effects and the cost-effectiveness ratio shall be the main criteria for the selection of the strategies and measures proposed*".

It is necessary to distinguish between 'soft' strategic measures (for instance, town and traffic planning) and 'hard' (engineering) measures at noise hotspots (areas where limiting values are exceeded). The latter have comparatively high noise reduction potential but also vary significantly in terms of their costs. Typical noise reduction potentials of common measures for road traffic noise are shown in the following table:

Table 3.13 Measures – and levels of Noise Reduction / Effect

Measure	Potential Noise Reduction / Effect
Low noise road surface	Max. 4-5 dB(A)
Speed reduction (e.g. from 50 → 30 km/h)	2-3 dB(A)
Reduction truck traffic (e.g. Truck routing)	4-6 dB(A) (reduction by 50 % and high rate of heavy trucks on total traffic)
Walls, barriers, tunnels, etc.	Maximum 10-20 dB(A)
Passive Noise protection (windows, ventilator)	Healthy living and sleeping conditions within buildings, approx. 15 dB reduction through closed window compared to a canted window.

Source: ACCON

In order to assess the net benefits of END implementation, reference is made to good practice in noise action planning and specifically those measures that have demonstrably positive Net Present Values (or a cost-benefit ratio less than 1).

The effects of implemented measures vary depending on factors such as:

- The boundary conditions such as number of affected persons by noise from each of road, rail and air (within and outside of agglomerations); and
- Source-specific factors (e.g. background noise, composition of traffic or geometrical considerations).

The costs of any particular measures also vary by location and are influenced by factors such as regional differences in the costs of labour and materials and other geographical and technical factors (e.g. topography, need for and costs of obtaining planning consents, etc.).

As a result, the cost-benefit-ratio may also differ between places. Nevertheless, even unrepresentative samples (drawn from the suite of 19 test cases) of investigated cost-benefit ratios for typical measures or combinations of measures, and assessed over a 25 year timeframe (2002-2026), show clear tendencies with regard to the overall economic benefit. For instance, the detailed CBA assessment (and supporting methodology) provided in Appendix D shows that:

- The cost-benefit ratio of various programs for **improvement of windows at three major airports** (Frankfurt, Stuttgart and Vienna) vary between 1:3.7 and 1:9.2 with an average ratio of 1:3.8.
- The implemented noise reduction measures (mainly barriers and walls) at all **major railways in Austria** between 2008 and 2013 (R1 and R2 Strategic Noise Mapping) show a cost-benefit ratio of 1:5.7
- The implementation of similar combinations of measures at **major roads in Austria** results in a cost-benefit ratio of 1:8.1.

It is further assumed that the more measures with cost-benefit ratios greater than 1 are implemented, the more effective is the END and the associated benefits in terms of reductions in harmful levels of noise and improvements in health outcomes. The transition to common assessment methods by implementing Commission Directive (EU) 2015/996 from R4 onwards should make it easier to quantify the health effects of noise reduction, which in turn will allow for a better appreciation of the benefits of noise mitigating measures as contained in NAPs. Reference should be made to the subsequent sub-section, where the findings from the cost-benefit assessment is set out in further detail. The methodological approach to the CBA is summarised in detail in Appendix D.

3.2.4.6 *Measure-level assessment of costs and benefits*

It is possible to conduct a methodologically robust EU-wide CBA of the implementation of the END, but not a precise one at the present time. This is largely because many of the measures identified in Noise Action Plans (NAPs) have either not yet been implemented or were already underway before the NAPs were produced and thus cannot necessarily be attributed to the END. A more detailed discussion of the approach to, and limitations of, the CBA is presented in Section 3.2.4.5 and in Appendix D.

It is also possible to derive a very broad indication of the relative costs and benefits of implementation of the END for typical measures (or packages of measures) relevant to agglomerations and major roads, major railways and airport infrastructure in such a way that also satisfies the requirements of Art. 11 (3) Review and Reporting of the END which states that "*the report shall include a review of the acoustic environment quality in the Community. […] The reduction of harmful effects and the cost-effectiveness ratio shall be the main criteria for the selection of the strategies and measures proposed*".

It is necessary to distinguish between 'soft' strategic measures (for instance, town and traffic planning) and 'hard' (engineering) measures at noise hotspots (areas where limiting values are exceeded). The latter have comparatively high noise reduction potential but also vary significantly in terms of their costs. Typical noise reduction potentials of common measures for road traffic noise are shown in the following table:

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Passive Noise protection (windows, ventilator)	Healthy living and sleeping conditions within buildings, approx. 15 dB reduction through closed window compared to a canted window.

Source: ACCON

In order to assess the net benefits of END implementation, reference is made to good practice in noise action planning and specifically those measures that have demonstrably positive Net Present Values (or a cost-benefit ratio less than 1).

The effects of implemented measures vary depending on factors such as:

- The boundary conditions such as number of affected persons by noise from each of road, rail and air (within and outside of agglomerations); and
- Source-specific factors (e.g. background noise, composition of traffic or geometrical considerations).

The costs of any particular measures also vary by location and are influenced by factors such as regional differences in the costs of labour and materials and other geographical and technical factors (e.g. topography, need for and costs of obtaining planning consents, etc.).

As a result, the cost-benefit-ratio may also differ between places. Nevertheless, even unrepresentative samples (drawn from the suite of 19 test cases) of investigated cost-benefit ratios for typical measures or combinations of measures, and assessed over a 25 year timeframe (2002-2026), show clear tendencies with regard to the overall economic benefit. For instance, the detailed CBA assessment (and supporting methodology) provided in Appendix D shows that:

- The cost-benefit ratio of various programs for **improvement of windows at three major airports** (Frankfurt, Stuttgart and Vienna) vary between 1:3.7 and 1:9.2 with an average ratio of 1:3.8.
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It is further assumed that the more measures with cost-benefit ratios greater than 1 are implemented, the more effective is the END and the associated benefits in terms of reductions in harmful levels of noise and improvements in health outcomes. The transition to implementing Commission Directive (EU) 2015/996 should make it easier to quantify the health effects of noise reduction, which in turn will allow for a better appreciation of the benefits of noise mitigating measures as contained in NAPs. Reference should be made to the subsequent sub-section, where the findings from the cost-benefit assessment is set out in further detail. The methodological approach to the CBA is summarised in detail in Appendix D.

3.2.4.7 Findings from the cost-benefit assessment

EQ13 - To what extent does the Directive demonstrate cost-effectiveness based on an assessment of the costs and benefits to date?

The efficiency of the END at EU level was assessed using information from 19 test cases to populate a cost-benefit analysis (CBA) framework. These test cases provide a broad indication of the relative costs and benefits of END implementation in specific agglomerations and for specific roads, railways and airports. The test case findings were then extrapolated to give a picture of the order-of-magnitude costs and benefits of END implementation at the EU level. The primary criterion for the selection of test cases was the availability of data necessary to support the CBA.

Nevertheless, in several cases, the data was either incomplete or not comparable. In these instances costs were estimated based on professional judgement and knowledge of similar agglomerations and major infrastructure elsewhere across the EU-28 MS (EU-28). The specific sources of all costs (actual and estimates) are identified for each test case in Appendix L.

The scope of the CBA is described in detail in Appendix D. In summary, it covers:

- Direct **administrative compliance costs** relating to the implementation of the END, such as the preparation of strategic noise maps and the development of noise action plans (including making provision for public information and consultation);
- The **substantive compliance costs** associated with implementing the measures identified in the Noise Action Plans; and
- The benefits to those experiencing a reduction in noise levels expressed in relation to improvements in three health endpoints: annoyance, sleep disturbance and cardiovascular disease.

Note that costs are only included for those measures for which information on costs and number of people affected is available (from the NAPs, personal communications, other secondary sources or professional judgment) and for which it is possible to determine the number of beneficiaries (i.e. the number of people who benefit from reduced noise as a result of the measure or a package of measures). While estimates of beneficiaries can be made for individual measures, it is not possible where cost information is only provided for groups of measures (unless specifically stated in the NAP).

In addition to producing case studies to obtain data on investment by MS in noise mitigation measures, some limited further data was obtained through discussions with national CAs. For instance, in France, the END was found to have increased the visibility of environmental noise and there is additional resource devoted to tackling the problem at national level across different sources, as described below.

Box 3.7 - Estimates of the substantive costs of END implementation in France

Substantive costs of noise measures

France was one of the few MS able to provide national level data on its expenditure on implementing noise mitigation and reduction measures mentioned in NAPs. Among the expenditure measures implemented are improvements to road infrastructure and replacing with quieter road surfaces, soundproofing and window insulation measures for households affected by noise. Examples of the level of annual expenditure provided per annum were:

Major roads - €100 million per year on quiet roads and other noise mitigation measures. €50 million / annum of the budget comes from the French state and €50 million from the communes.

Aircraft noise **-** €50 million. The budget is devoted to soundproofing and window insulation measures for people affected by aircraft noise.

The importance of including **low-cost and no-cost measures** was also emphasised, such as:

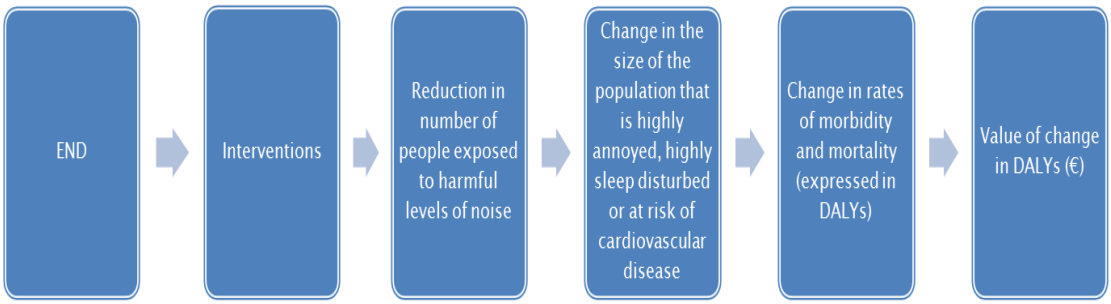
Taking environment noise into account in the planning and urban development process. Examples were not ensuring that the planning guidelines do not allow building new residential housing too close to airports.

Integrating noise mitigation into design principles from the outset – e.g. in building design, ensuring that new house construction is more noise conscious for instance, by putting bathrooms and bedrooms away from the façade facing major roads.

Source: interview with the French national Competent Authority

In order to help define the CBA framework, an impact pathway or logic chain was developed (see Figure below). This provides a structured and transparent way of linking the sequence of events between implementation of the END and the outcomes or impacts that can be valued in monetary terms, and the assumptions that may be implicit within that.

Figure 3.11 - The impact pathway



Thus, it is assumed that the introduction of the END has supported a number of activities or interventions including strategic noise mapping, noise action planning (both compliance activities) and, following these, the implementation of a range of measures to reduce harmful levels of noise. While the implementation of measures is not specifically mandated by the END, there is an implicit assumption or reasonable expectation that the measures identified in the Noise Action Plans (NAPs) will be implemented. Indeed, the implementation of many of these measures is already underway and some have already been completed.

The implementation of these measures in turn contributes to a reduction in the number of people exposed to harmful levels of noise. The benefits are considered in terms of a reduction in the burden of disease caused by environmental noise.

These are quantified using published disability weights (DWs) to arrive at a standard health metric expressed in terms of disability-adjusted life years (DALYs) and valued in terms of the value of a life year (VOLY).

DALYs indicate the estimated number of healthy life years lost in a population from premature mortality or morbidity, i.e. the health burden. The DALY is calculated as the weighted sum of years of potential life lost due to premature mortality and the years of productive life lost due to disability.

The recommended values for DWs for various disease states are set out in WHO (2011) and have been used to support this CBA. The specific values that have been used in the analysis for sleep disturbance and annoyance are shown in Table 3.15.

Table 3.15 - Disability weights used in the analysis

Health endpoint	Recommended Value	Low	High
Sleep disturbance	0.07	0.04	0.10
Annoyance	0.02	0.01	0.12

Note, however, that there are no published disability weights applicable to the low and moderately annoyed and sleep disturbed populations. As a result, the CBA only considers the value of changes in the highly annoyed and highly sleep disturbed populations.

In line with the approach presented in WHO (2011), we make use of WHO health statistics[151] for estimates of the DALYs relating to cardiovascular disease (acute myocardial infarction and hypertension) in each MS. As DALYs for myocardial infarction are not published, we applied the values relating to ischaemic heart disease. Thus, for the sake of DALY calculation, we assume that road traffic noise has a similar impact on all ischaemic heart disease as on myocardial infarction.

For the purpose of this CBA, the VOLY is taken as €110,987. This is the same as that used in the CBA of the Air Quality Package for Europe[152], adjusted to 2014 prices using the Eurostat GDP deflator. This value has been applied across all MS as it was considered neither practically possible nor politically appropriate to use different values and also because there is also the practical challenge of getting such values from MS. Sensitivity tests were also run using the lower- and upper-bound estimates (with a range from €67,163 to €154,812) provided by the EC as having been used in other impact assessments.

Sensitivity analyses have also been conducted to test how the outcomes may differ under a range of different assumptions regarding the extent (from 25-100%) to which the measures can be attributed to END. The efficiency of measures is then assessed using typical decision criteria – in this case, net present value (NPV) and cost-benefit ratios. Costs and benefits are assessed over a 25-year period (2002 to 2026) and discounted using the 4% social discount rate recommended by the European Commission. All values are expressed in 2014 prices.

The specific steps undertaken to quantify the costs and benefits and the overall net present value (NPV) of typical measures implemented as a result of the END are described in detail in Section 3 of Appendix D. This should be read in conjunction with Appendix E (Methodology for the case studies), Appendix F (Test case summaries) and Appendix L (Input data sheets) for a more complete understanding of the methodology, data inputs and analysis of test case data that is presented in summary form below.

[151] WHO (2014) Health Statistics - Environmental Burden of Disease (2012). Online at http://www.who.int/healthinfo/global_burden_disease/estimates/en/index2.html

[152] EMRC (2014) Cost-benefit Analysis of Final Policy Scenarios for the EU Clean Air Package Version 2 Corresponding to IIASA TSAP Report 11, Version 1 March 2014 [online] available at http://www.iiasa.ac.at/web/home/research/researchPrograms/MitigationofAirPollutionandGreenhousegases/TSAP_CBA_corresponding_to_IIASA11_v2.pdf

Limitations of the analysis

There are a number of factors that limit the reliability of the EU-wide assessment of costs and benefits and therefore the results need to be treated with caution. In particular:

- The total cost and benefit estimates are partial.
    - They do not include the costs and benefits associated with measures to reduce harmful levels of noise in agglomerations. This is because the data pertaining to agglomerations across the 10 test cases examined was largely incomplete and not considered sufficiently reliable to support a robust extrapolation. The cost-benefit analysis of agglomerations was therefore limited to an analysis of the costs and benefits of typical measures applied in agglomerations.
    - They only cover a subset of the total range of measures identified in MS' NAPs. Only those measures for which reliable and comparable cost and benefit information was available were included.
- The benefit estimates are understated.
    - They only account for the benefits associated with noise reductions amongst the highly annoyed and highly sleep disturbed populations. They do not consider the benefits to those that experience low or moderate levels of sleep disturbance and annoyance. This is because there are no published disability weights applicable to the low and moderately annoyed and sleep disturbed populations. Alternative approaches using revealed or stated preference approaches, and which would capture the effects of transportation noise on low, moderately and highly affected residents were considered but themselves suffer from a number of limitations (see Box 1 in Appendix D). Not least of all, the values of willingness to pay for reductions in noise levels derived from these approaches exhibit a wide range and are thus considered less reliable for the purposes of extrapolation.
    - The benefit estimates also do not include the potential gain in property values as a result of reduced noise. Studies suggest that a 1 dB increase in noise levels can reduce house prices by between 0.08 and 2.22% depending on the noise source. These values are, however, likely to already reflect perceived amenity effects of annoyance and sleep disturbance[153]. Including changes in property values alongside the values attributed to changes in each of the three health endpoints in the analysis would therefore result in some degree of double counting.
    - They do not include the benefits in the form of cost savings from a reduction in hospital admissions (costs borne by individuals) and lost productive days (costs to employers). These are nevertheless likely to be small in relation to the value of avoided DALYs.
    - In contrast, while some of the measures included in the assessment have not yet been fully implemented, the benefits estimates are calculated assuming that the measures have been fully implemented. The benefits associated with some measures are thus somewhat overstated.
- The cost estimates, particularly in relation to roads and airports) are understated.
    - The indirect costs of measures (such as increases in transport costs and greenhouse gas emissions as a result of changes to routes, etc.) are not

[153] Bristow, A.L. and Wardman, M. (2015) Comparing noise nuisance valuation estimates across methods, meta-analysis, time and space. Paper presented at the 22nd International Congress on Sound and Vibration (ICSV 22), Florence, Italy, 12-16 July 2015.

included. These are nevertheless likely to be low relative to the direct costs of measures.

- The **test case costs and benefits are not necessarily representative** of the situation across the EU and the extrapolation was performed using a limited sample.
- **The degree to which costs and benefits can be attributed to the END is partly unknown.** For example, some of the measures that have been included in the analysis began to be implemented before the first round of NAPs were published and there may also be other reasons (unrelated to the END) why noise levels have diminished in certain areas (e.g. changes in the road network, or infrastructure upgrades). In the absence of any quantitative evidence relating to the effects of other (non-END) interventions, various assumptions have been made around the extent to which the costs and benefits of measures can be attributed to the END.

- In particular, the analysis assumes that the degree of attribution is lower in those MS in which noise legislation was in existence prior to the introduction of the END (assumes only 50% attribution in the base case) and that the benefits are highest in situations where no previous noise legislation existed but where a NAP has been produced. The specific levels of attribution that have been applied in the analyses are set out in the sections relating to each of airports, roads, railways and agglomerations that follow. While different assumptions about the level of attribution have been tested in the sensitivity analyses, the assumptions that have been applied were formulated for the purposes of illustration only using professional judgement and may not accurately reflect the actual situation.

It is also important to note that there are a number of potentially important effects that the CBA does not consider. There are various reasons for this including difficulties in establishing reliable estimates of the impacts[154] and the potential for double counting. Some of these effects include:

- The influence of the END on **land use planning and residential development.** This is because it is not possible to place a monetary value on the contribution of the END to land use planning in such a way that it could be incorporated into the CBA. There is nevertheless evidence to suggest that noise concerns, driven by the END, are relevant to the siting and design of new developments. For example, Planning Practice Guidance and Planning Advice Notes issued by the Governments of England and Scotland respectively promote the appropriate location of new potentially noisy development, and a pragmatic approach to the location of new development within the vicinity of existing noise generating uses, to ensure that quality of life is not unreasonably affected and that new development continues to support sustainable economic growth.
- The effects of the END on direct, indirect or induced **employment.** Again, it is not straightforward to quantify the contribution of END to employment in monetary terms. It is nevertheless likely that there will have been some employment gains in terms of the specific requirements of the END in relation to preparation of strategic noise maps and action plans, as well as in the design and implementation of noise-reduction measures.
- The impacts of measures such as changes in flight paths, ascent/descent rates and scheduling on **greenhouse gas emissions and air quality**. While it is theoretically possible to calculate the additional air miles (and hence emissions and impacts) accrued as a result of changes in flight paths and scheduling, this would necessitate the collection and analysis of a number of additional datasets from across the test

[154] In this case, the effort applied was proportionate to the estimated magnitude of the impact, outcomes at stake and resources available. Impacts were excluded from the analysis in cases where the level of effort required to generate quantified estimates was considered disproportionate to the importance of the impact relative to other impacts.

cases. This was not considered proportionate to the outcomes at stake and the time available.

The quantitative analysis also does not consider other relevant benefits of the END in relation to:

- **Raising awareness of and stimulating discussions around environmental noise as an issue.** Data from noise mapping has supported assessments of the effects of changes in environmental noise on health, productivity and ecosystem services which in turn have been used to influence decision-makers.
- **Generating large and consistent datasets on noise** (through SNMs) that have been invaluable in advancing research on the effects of noise on health and productivity.
- **Supporting actions in other areas** (e.g. development of technical standards, emission levels and other Directives) that have a positive effect on noise levels, unless these can be explicitly linked to the END.

A summary of the 19 test case findings for each of major airports, roads, railways and agglomerations is provided below. The results presented in the tables below represent a situation in which 100% of the costs and benefits can be attributed to END implementation, unless otherwise stated. Benefit estimates are also presented in terms of central (base case), low and high values which are summarised in the table below. The low and high values represent the end point of the range in which the actual values are expected to lie and reflect differences in underlying assumptions regarding the value of a life year (VOLY) and the disability weights for each of sleep disturbance and annoyance.

Table 3.16 - Parameters used for sensitivity testing

	Base case	Test 1 (Low / worst case scenario)	Test 2 (High / best case scenario)
Disability weight for annoyance	0.02	0.01	0.12
Disability weight for sleep disturbance	0.07	0.04	0.1
VOLY	€110.987	€67,163	€154,812

Airports

The test cases covered five airports:

- Glasgow (United Kingdom)
- Stuttgart (Germany)
- Athens International (Greece)
- Vienna International (Austria)
- Frankfurt (Germany)

For the purposes of extrapolating the test case data across all major airports, the costs and benefits of each of the five test cases have been applied to other airports across the EU using information on both the airport size (total annual air traffic movements and size of the population exposed to harmful levels of noise (> 55 dB L_{den}). For each class, the average (median) size of the population exposed to noise levels exceeding 55 dB L_{den} was estimated using information from the EIONet database. All EU-28 airports that are required to report and for which data exists have been classified into one of the size bands shown in Table 3.17 below. The table also shows which of the test cases correspond to each class.

So, for example, Glasgow is taken to be broadly representative of all airports with fewer than 100,000 air traffic movements per year although, where considered necessary, further adjustments have been made (see Appendix D) to the test case data prior to extrapolation to account for any known anomalies (e.g. maturity in addressing noise issues or location) that may determine whether or not the test case estimates can be considered representative of other airports of that size.

Table 3.17 - Classification of test case airports by size

Airport	Representative of airports with annual air traffic movements
Glasgow	<100,000
Stuttgart	100-150,000
Athens	150-200,000
Vienna	200-250,000
Frankfurt	>250,000

For each test case, the number of people exposed above 55 dB L_{den} is used to derive per person estimates of costs and benefits. It is important to note that this cost or benefit per person is not the cost or benefit per single beneficiary of the noise reduction measures; rather, it is an averaged cost or benefit that considers both those people that benefited from the noise reduction measures and those that did not. The average benefit per person is therefore simply an indicator of the performance at airport level. Neither is it an assessment of the effectiveness of specific measures (i.e. the value of the benefit derived by those that directly benefit from the measure), as the beneficiary population is a subset of the total population affected by noise.

On the basis of the test case data, the discounted **administrative costs** of END implementation (noise mapping, consultants, etc.) vary between €52,000 (at Athens airport) and almost €3 million (at Frankfurt airport). The variation in costs can be explained, at least partly, by the level of effort (including extent of public consultation) invested in preparing the NAPs. For Vienna airport, for example, the NAP is a relatively simple document prepared by a single person over a short period of time. However, in other cases (e.g. Frankfurt), the process of preparing a NAP is an extensive exercise involving multiple people (which may include consultants) and public consultation. The cost per affected person has also been calculated using information on the total population exposed to noise levels in excess of 55 dB L_{den} before the implementation of measures.

The range of measures implemented across airports is quite similar and includes a mix of operational changes, flight time restrictions and noise insulation measures (sound proofing and ventilation). However, the **costs of measures** published in the NAPs vary significantly. There are a number of possible explanations for this. First, in some EU MS, the costs of measures are estimated on the basis of all measures that could potentially be implemented while in others the costs relate only to those measures for which a specific budget has already been allocated. Second, the costs are likely to vary by the size of the population affected: the larger the total number of households affected, the greater expenditure is to be on sound-proofing measures (one of the most commonly applied measures to reduce noise from airports). And third, some airports (more than 15) will have introduced noise reduction measures some time ago in response to national legislation and can now only make marginal improvements while others will be starting from a completely different base.

Moreover, the costs presented in the test cases are not directly comparable because they cover different measures (e.g. Stuttgart only includes costs of soundproofing measures) while in others (e.g. Vienna) they are relatively complete. The actual costs of measures were not available for Glasgow or Athens and therefore these costs were estimated using secondary information (e.g. the Glasgow Airport Master Plan) and assumptions made on the basis of professional judgement (e.g. it is assumed that only 0.5% of the total costs of improvements at Glasgow Airport are related to measures to reduce noise levels).

The table below shows the costs associated with each of the test case airports.

Table 3.18 - Summary of costs of END implementation for major airports (test cases)

	Glasgow	Stuttgart	Athens	Vienna	Frankfurt
Size (ATMs, 2014)	83,999	127,678	154,530	249,989	469,026
Representative class	< 100,000	100-150,000	150-200,000	200-250,000	>250,000
Population exposed to noise > 55 dB L_{den}	68,800	44,200	14,970	12,300	238,700
Costs of END implementation (administrative costs)					
Total costs of implementation (€)	101,127	120,362	51,776	70,367	2,600,849
Cost per affected person (€)	1.47	2.72	0.80	5.72	10.90
Costs of measures					
Total costs of measures (€)	287,759	54,366	523,979	21,965,699	12,449,063
Cost per affected person (€)	4.18	1.23	8.14	1,785.83	52.15
Total costs (€)	**388,886**	**174,728**	**575,755**	**22,036,066**	**15,049,912**
Total costs per person (€)	**6**	**4**	**9**	**1,792**	**63**

For the purposes of extrapolation, the test case estimates have therefore been adjusted to take account of:

- The reliability and completeness of the data in the test case (e.g. whether the costs have been obtained from primary sources, published information or estimated using secondary data and whether they cover the costs of all measures are only a selection of measures);
- The relative size (in terms of aircraft movements per year) of each of the test case airports in relation to other airports within that size band;
- The characteristics of the test case airport to which they apply (e.g. number of runways and density of surrounding population) relative to a 'typical' airport within the corresponding size band; and
- The extent to which the public was consulted in the development of the NAPs for each of the test case airports (where known) as this has a bearing on the administrative costs.
- The administrative costs of END implementation are assumed to be the same for all airports and are estimated to be around €5 per noise-affected person. This is slightly higher than the median of the test case values but accounts for the fact that the per person costs at Glasgow and Stuttgart Airports are likely to be lower than at other airports as the total costs are spread across a much larger population while the opposite is true of Frankfurt airport.

For the costs of measures, the average (€919) of the estimates from the Vienna (€1,785) and Frankfurt (€52) test cases has been used. The Vienna and Frankfurt costs estimates are considered to be the most reliable as they are based on published information and cover a range of typical measures implemented at airports. The costs of measures for all the other airports are either incomplete (they cover only selected measures) or have been derived from secondary information. The per person estimates have then been scaled up to provide estimates of the total costs of measures based on the median size of the population exposed to noise levels exceeding 55 dB L_{den} for all airports in each size band.

A further distinction is then made between those airports that had noise legislation prior to the introduction of the END and those that did not. For those airports with pre-existing legislation, it is assumed that some of the costs of measures would have been incurred anyway in order to comply with domestic regulatory requirements. It is thus assumed that only 50% of the total costs can be attributed to END for airports within MS that had noise legislation prior to the introduction of the END.

Finally, the adjusted costs are extrapolated across all EU-28 airports by assuming that all the airports within each size band will incur the same costs as the model or representative airport. The total cost for the representative airport (for each of without and with pre-existing noise legislation) is then multiplied by the total number of airports within that size band to provide an indicative cost across the EU-28 major airports for which exposure data was available.

The analysis was then further refined to take account of the status of NAPs for each of the major airports. It is assumed, for example, that in the case where an airport has not produced a NAP, then it should also be attributed a lower level of costs (and benefits). In effect, the absence of a NAP is taken to indicate that the implementation of noise-reduction measures is not necessarily driven by the END; it may, however, be driven by pre-existing legislation or other factors (e.g. pressures from the local community or other interest groups). As such, the costs and benefits associated with the implementation of measures are likely to have been incurred regardless of the END.

Similarly, for airports in MS with no pre-existing noise legislation but where a NAP has been produced, then it is assumed that 100% of the costs (and benefits) can be attributed to the introduction of the END. For those airports with pre-existing legislation, it is assumed that some of the costs of measures would have been incurred anyway in order to comply with domestic regulatory requirements. It is assumed that only 50% of the total costs can be attributed to END for airports within MS that had noise legislation prior to the introduction of the END. The specific factors that have been used to attribute costs to END for each major airport type within each band are shown in Table 3.19:

Table 3.19 - Factors used to attribute costs to major airports in the base case

Status	%
No legislation, NAP	100
No legislation, no NAP	25
Legislation, NAP	50
Legislation, no NAP	50

Similar to the approach described above, the costs for each model/representative airport are then multiplied by the number of airports within that category, (taking account of both NAP status and whether or not the airport is within a MS with pre-existing noise legislation. The resulting estimates are shown in Table 3.20 below.

Table 3.20 - Total costs of END implementation for major airports across the EU

Airport size	< 100,000	100-150,000	150-200,000	200-250,000	>250,000	Total
No. of airports within class without pre-existing legislation and with a NAP	1	-	1	1	1	4
Total costs (€, millions)	2.77	-	9.42	8.13	1	21.25
No. of airports within class without pre-existing legislation and with no NAP	9	2	1	1	2	15.00
Total costs (€, millions)	24	2	0.0	11	12	49.50
No. of airports within class with pre-existing legislation and with a NAP	9	5	5	2	4	25
Total costs (€, millions)	2	29	21	2	110	164.29
No. of airports within class with pre-existing legislation and with no NAP	18	4	4	1	3	30
Total costs (€, millions)	25	34	82	14	48	202.59
GRAND TOTAL (€, millions)	54.33	65.05	112.52	35.46	170.27	437.63

The benefits associated with the implementation of noise reduction measures are driven largely by the change in the size of the exposed population and will therefore be more significant for those airports that have higher populations exposed to higher levels of noise and where measures to reduce harmful levels of noise have been introduced under the END.

It is important to note that data from Strategic Noise Mapping (SNM) does not reflect the effects of sound-proofing measures. This is because noise measurements are taken at the external façade of buildings and thus do not take account of the reduction in indoor noise levels that would be obtained as a result of sound-proofing. Where necessary (i.e. where the change in the size of the exposed population is based on SNM data, the benefit estimates have been adjusted (by setting the population exposed to night-time levels in excess of 50 dB L_{night} after measures to zero) to take account of the reduction in indoor noise levels and thus sleep disturbance results.

On this basis, the discounted total benefits over a 25-year assessment period range from €37 million at Stuttgart Airport to €1,046 million at Frankfurt airport – see Table 3.21 below. On a per person basis, and using the available test case data, the benefits range from €84 at Stuttgart to €495 at Glasgow.

Table 3.21 - Summary of benefits of END implementation for major airports (test cases)

	Glasgow	Stuttgart	Athens	Vienna	Frankfurt
Size (Total air traffic movements, 2014)	83,999	127,678	154,530	249,989	469,026
Representative class	< 100,000	100-150,000	150-200,000	200-250,000	>250,000
Population exposed to noise > 55 dB L_{den}	68,800	44,200	64,364	12,300	238,700
Health benefits of END implementation					
Total benefits (€, millions) - central values; 100% attribution	340	37	107	54	1,046
Benefit per person (€, millions) - central values; 100% attribution	494.62	83.72	166.25	442.98	438.07
Total benefits (€, millions) - low values; 100% attribution	121	1	50	3	431
Benefit per person - (€) - low values; 100% attribution	1,763.08	27.92	783.38	230.51	1,807.24
Total benefits (€, millions) - high values; 100% attribution)	1,371	8	236	49	2,702
Benefit per person - (€) - high values; 100% attribution	19,920.48	183.74	3,668.93	4,007.73	11,321.07

For the purposes of extrapolation, we have used the median value of the central, low and high values (€4,380.69, €783 and €4,008 respectively) of the benefits per person across the five test case airports.

Similar to the approach used for the cost estimates, the per person benefit estimates are then scaled up to derive an estimate of total benefits based on the size of the median population exposed to noise levels in excess of 55 dB L_{den} for all airports within that size band (and for which data was available) and taking account of whether or not airports are located in MS with pre-existing noise legislation. The attribution factors applied within each of the scenarios are set out in the table below.

Table 3.22 - Attribution factors for estimating benefits from major airports

	Scenario		
	Low (Worst case) (% attribution)	Base Case (% attribution)	High (Best case) (% attribution)
No pre-existing noise legislation	50	50	100
Pre-existing noise legislation	25	50	100
Values	Low	Central	High

Note that the median exposure values for airports with more than 250,000 air traffic movements (ATMs) are likely to be skewed heavily by the presence of Heathrow Airport within this class. More people are affected by noise at Heathrow than at any other major European airport.

More than three times as many people fall within Heathrow's 55 L_{den} contour than at Frankfurt, which has the second highest number of people exposed to noise at this level[155]. The total benefits for airports within the > 250,000 size band may thus be somewhat exaggerated, particularly for those airports within fewer than 400,000 air traffic movements per year.

The benefits per airport in each size category are then extrapolated across all EU-28 airports by multiplying the total benefits in each size band and under each scenario by the total number of airports in each category, and accounting for whether or not each of the major airports had NAPs in place. It is assumed that where a major airport is located in a Member State that had no pre-existing noise legislation and the airport has produced a NAP, then 100% of the benefits can be attributed to END. In contrast, where there is no pre-existing legislation and no NAP, then only 25% of the benefits are attributed to the END. This is considered a conservative assumption as it is possible that no measures have been implemented at airports for which neither domestic noise legislation nor NAPs exist. The EU-wide figures are discussed further under the Aggregate Assessment heading and are shown in Table 3.29 (base case), Table 3.31 (worst case) and Table 3.32 (best case).

Major roads

The test cases covered major roads in two MS:

- Austria (2,500km)[156]
- Greece (75km – the Attica Tollway)

These test cases were selected on the understanding that it would be possible to obtain relevant information on noise exposure, the direct costs of END implementation and the costs of measures and because they are sufficiently different that they could illustrate the range within which the costs and benefits of other major roads across the EU-28 are most likely to lie. It is important to note that the per person costs and benefits are calculated as the total costs and benefits divided by the whole of the population affected by noise levels greater than 55 dB L_{den} and not just the beneficiaries of noise reduction measures.

The Attica Tollway serves as a ring road for the greater metropolitan area of Athens and, as such, the population density along the road is relatively high. By contrast, the major roads in Austria traverse much of the country and pass through both highly populated and less populated areas. In order to improve the reliability of the extrapolation, estimates of the administrative costs from the two test cases was supplemented by information that was collected at a Member State level to support the implementation review (see Section 3.2.4.2) and which was comparable to the test case data (in terms of coverage or unit of analysis) and thus could be easily incorporated into the CBA. In this light, suitable supplementary information on administrative costs and measures was available from France, Spain and England (within UK) only.

The table below shows the costs estimates for each of the test case roads, as well as the supplementary cost information.

[155] http://www.aef.org.uk/issues/aircraft-noise/

[156] Note that although the total length of major roads reported in the EIONet Database is over 5,000 km, the test case only considers those roads that fall under the responsibility of the national authority. Roads that fall under the responsibility of federal authorities were not included in the test case.

Table 3.23 - Costs of END implementation along major roads (test cases)

	Austria	Greece	Spain	France	UK (England only)
Total length of road	2,500	70	19,552	24,972	25,472
Total population affected by noise (before measures)	591,001	28,000	1,243,600	3,492,200	5,704,000
Average population density (people per km)	236	400	64	140	224
Costs of END implementation (administrative costs)					
Total costs of implementation (€)	1,004,838	40,938	3,739,906	4,000,000	117,720.60
Total implementation costs per km (€)	401.94	584.83	191.28	160.18	4.62
Cost per affected person (€)	1.70	1.46	3.01	1.15	0.02
Costs of measures					
Total costs of measures (€)	146,579,116	63,602,648	178,335,906	178,335,906	62,470,750
Total costs of measures per km (€)	58,632	908,609	9,121	7,141	2,453
Cost per affected person (€)	248.02	2,271.52	143.40	51.07	10.95
Total costs (€)	**147,583,954**	**63,643,586**	**182,075,812**	**182,335,906**	**62,588,471**
Total costs per km (€)	**59,034**	**909,194**	**9,312**	**7,302**	**2,457**
Total costs per person (€)	**250**	**2,273**	**146**	**52**	**11**

As can be seen from the table above, the total costs of END implementation (administrative costs plus costs of measures) vary substantially, ranging from €2,453 per km in England to over €900,000 per km in Greece. When considering the average population density along major roads, the costs range from around €11 per person per km in England to over €2,200 per person per km in Greece. These costs are not, however, strictly comparable as they:

- Cover different packages of measures. For example, the Greek test case considers only the costs of a noise barrier while the Austrian test case considers a range of measures including implementation of barriers, walls and/or passive noise protection.
- Apply to different lengths of roads and population densities along the road. For example, the average number of people per km of road is almost twice as high in Greece as it is in Austria.

The differences in costs are also likely to reflect, at least to some extent, the different stages that these MS are at in terms of addressing road traffic noise and therefore what levels of expenditure are still required to reduce exposure of the population to harmful levels of noise. The test case cost data was then scaled up to an EU level taking account of:

- The total length of major roads in EU MS with more than 3 million vehicle movements per year;
- The availability of information on road noise exposure in those MS that are required to report on road noise;
- The average density of the population per km of road, grouped into four broad classes;
- The median size of the population exposed to noise levels higher than 55 dB L_{den} and 50 dB L_{night} within each class;
- Whether or not each of the MS within that class had pre-existing noise legislation. The same assumptions as those used for the analysis of airports (see Table 3.22) were applied in relation to levels of attribution; and
- The range of costs (low, medium and high).

The benefits of END implementation along major roads are estimated in respect of changes in the number of people exposed to harmful levels of noise as a result of the implementation of noise abatement measures and the associated improvements in health. For each test case, the total benefits were estimated for a central (most likely) scenario and by varying the parameters to provide the extent of the range in which the value of benefits could potentially lie. The table below shows the estimated total benefits and average benefits per person assuming 100% attribution and using central estimates for disability weights and VOLYs.

Table 3.24 - Benefits of END implementation for major roads – test case summary

	Austria	Greece
Benefits (€, millions), assuming 100% attribution and using central estimates for disability weights and VOLYs	1,267	176
Average benefit per person (€)	2,144	6,303

Using the same approach as for the cost estimates, the test case benefit estimates have been scaled up on the basis of the total length of major roads across the MS for which exposure data was available[157] and accounting for differences in average population density along major roads in different MS, whether or not each MS had pre-existing noise legislation and the proportion of major roads in each MS that are covered by NAPs. The outcomes of the extrapolation are discussed further under the Aggregate Assessment heading and are presented in Table 3.29 (base case), Table 3.31 (worst case) and Table 3.32 (best case).

[157] The estimate does not include Estonia, Cyprus, Slovenia, Hungary and Czech Republic as there was no data available for these Member States.

Railways

For the purposes of the evaluation, two major railways were selected as test cases for analysis. These were selected on the basis that information on costs and benefits (in terms of changes in the number of people exposed to noise from rail traffic) was available. The two test cases were:

- Austria's national rail network, covering some 2,218 km; and
- Two sections (506 km) of railway running through hotspot areas (Malacky and Plavecky Strvtok) in Slovakia. Malacky is an important regional transport hub connected to a highway and national road that services the capital, Bratislava. The train line, which connects Bratislava and the Czech Republic, traverses the city.

Similar to the approach used for airports and major roads, the costs and benefits of END implementation within each of the test cases was used to estimate the average costs and benefits per person for the population exposed to noise levels higher than 55 dB L_{den}. As noted previously, the per person costs and benefits are calculated as the total costs and benefits divided by the whole of the population affected by noise levels greater than 55 dB L_{den} and not just the beneficiaries of noise reduction measures.

The total costs (i.e. costs of compliance plus costs of measures) of END implementation per kilometre are broadly similar for each of the test cases: Slovakia (€6,629 per km) and Austria (€8,944 per km). They are not, however, strictly comparable as they:

- Cover different packages of measures. The Slovakian test case considers only the costs of a noise barrier while the Austrian test case considers a range of measures including implementation of barriers, walls and/or passive noise protection.
- Apply to different lengths of railways and population densities along the railway. The average number of people per km of rail track is approximately 14 times higher in Austria (437) than it is in Slovakia (32) and the number of people per kilometre exposed to noise levels in excess of 55 dB L_{den} is 26 times higher in Austria than it is in Slovakia.

The cost estimates per km have therefore been adjusted to make them more comparable with the benefit estimates by taking account of average population density in each case. On this basis, the costs per person are €20 in Austria and €205 in Slovakia.

The table below shows the costs and benefits respectively for each of the test case roads, as well as some supplementary cost information available from France.

Table 3.25 - Present value costs of END implementation along major railways (test cases)

	Austria	Slovakia	France
Total length of railway (km)	2,218	506	7,239
Total population along length of railway	968,877	16,400	1,018,800
Average population density (noise-affected people per km)	437	32	141
Costs of END implementation (administrative costs)			
Total costs of implementation (€)	487,155	22,689	672,408
Total implementation costs per km (€)	219.64	44.84	92.89
Cost per affected person (€)	0.5	1.38	0.66
Costs of measures			
Total costs of measures (€)	19,350,869	3,331,587	700,000

	Austria	Slovakia	France
Total costs of measures per km (€)	8,724	6,584	97
Cost per affected person (€)	20	203	0.69
Total costs (€)	**19,838,024**	**3,354,276**	**1,372,408**
Total costs per km (€)	**8,944**	**6,629**	**190**
Total costs per person (€)	**20**	**205**	**1.35**

The test case cost data was then scaled up to an EU level taking account of:

- The total length of railways in EU MS with more than 60,000 passages a year;
- The availability of information on railways and noise exposure in those MS that are required to report on railway noise;
- The average density of the population per km of road, grouped into four broad classes;
- The median size of the population exposed to noise levels higher than 55 dB L_{den} and 50 dB L_{night} within each class;
- Whether or not each of the MS within that class had pre-existing noise legislation. The same assumptions as those used for the analysis of airports were applied in relation to levels of attribution; and
- The range of costs (low, medium and high).

As with major airports and major roads, the benefits of END implementation along major railways are estimated in respect of changes in the number of people exposed to harmful levels of noise as a result of the implementation of noise abatement measures and the associated improvements in health. In particular, the benefits are expressed in terms of the reduction in QALYs relating to the decline in noise-related annoyance and sleep disturbance. There are no reliable dose-response relationships for cardiovascular diseases (acute myocardial infarction and hypertension) for railway noise.

For each test case, the total benefits were estimated for a central (most likely) scenario and by varying the parameters (relating to disability weights and the VOLY) to provide the extent of the range in which the value of benefits could potentially lie. The table below shows the estimated total benefits and average benefits per person assuming 100% attribution and using central estimates for disability weights and VOLYs.

Table 3.26 - Benefits of END implementation for major railways – test case summary

		Austria	Slovakia
Low (worst case)	Benefits (€, million), assuming 100% attribution and using low estimates for disability weights and VOLYs	38	16
	Average benefit per person (€)	39	959
Central (base case)	Benefits (€, million), assuming 100% attribution and using central estimates for disability weights and VOLYs	116	47
	Average benefit per person (€)	121	2,899

		Austria	Slovakia
High (best case)	Benefits (€, million), assuming 100% attribution and using high estimates for disability weights and VOLYs	626	199
	Average benefit per person (€)	646	12,158

Using the same approach as for the cost estimates, the test case benefit estimates have been scaled up on the basis of the total length of major railways across the MS for which exposure data was available[158], and accounting for both differences in average population density along major railways in different MS and whether or not each MS had pre-existing noise legislation. The resulting benefits estimates under each of the base case, worst case and best scenarios are shown in Table 3.29, Table 3.31 and Table 3.32 respectively.

Agglomerations

For the purposes of the evaluation, 10 agglomerations were selected as test cases for analysis. These were selected on the understanding that information on costs and benefits (in terms of changes in the number of people exposed to noise from all transportation sources within agglomerations) was readily available, either from the published NAPs or directly from the relevant authorities and other published sources.

The information obtained was, however, incomplete and was not sufficiently comparable across the test cases to support a reliable extrapolation. More specifically, the test cases varied widely with respect to:

- The **types of measures implemented**, the degree of implementation of measures and the number of affected persons exceeding limit values (which are country specific);
- The **sources of environmental noise** (some are affected by road, railway and airport noise while others only by one or two principal sources of noise).
- The **extent to which cost and benefit information was available** for the principal noise sources. For instance, while Nuremberg is affected by noise from roads, railways and airports, it was not possible to determine the combined effects (costs and benefits) of measures to address noise from these sources. Separate analyses were conducted for individual measures implemented in each of the test case agglomerations. These are detailed in Appendix F. Note that information on the costs and benefits of noise-reduction measures in Athens was not available and therefore cost-benefit ratios are only reported for nine of the ten agglomerations.

This is compounded by further challenges in that the agglomerations that are required to report under the END, all differ with respect to:

- **Population size and density**. This has a bearing on the cost-effectiveness of measures, particularly measures of a 'public good' nature (i.e. where the benefits of a measure extend beyond the specific population for which the measure was intended (non-excludable) and where there is no incremental cost of providing the measure to others (non-rivalrous);

[158] The estimate does not include Estonia, Cyprus, Slovenia, Hungary and Czech Republic as there was no data available for these Member States.

- **The principal sources of environmental noise**. While road traffic noise is common to all agglomerations; noise from railways and airports does not apply to all agglomerations;
- The **completeness of information** on the size of the population exposed to harmful levels of noise (> 55 dB L_{den} or 50 dB L_{night}), particularly in relation to noise from airports.

For this reason, rather than extrapolating from the agglomeration test cases, an indicative assessment of the efficiency of END implementation within agglomerations is made by considering the cost-benefit ratios associated with specific measures that were identified in the NAPs for each of the test cases and for which cost and benefit data exists. These measures may be considered typical of the range of measures implemented in agglomerations. It should be noted, however, that the per person costs and benefits are calculated according to the number of direct beneficiaries of the measure rather than according to the total number of people affected by noise levels exceeding 55 dB L_{den} as in the analyses for airports, roads and railways.

The resulting cost-benefit ratios for each of the measures in each test case are summarised in the table below. The costs shown in the table relate to the costs of measures only. The administrative costs associated with END implementation in agglomerations are small relative to the costs of measures (typically no more than around 3% of total costs) and would therefore have a negligible effect on the overall cost-benefit ratios. From the table, it can be seen that the spread in cost-benefit ratios is large, ranging from a situation in which costs appear to exceed the benefits for noise barriers in Munich (1:0.3) to a ratio of 1:14,335 for speed enforcement in Augsburg. Overall, measures to reduce the speed of road traffic and to reduce the numbers of heavy road vehicles appear to be the most cost-effective.

Table 3.27 - Cost-benefit ratios for individual measures in each test case agglomeration

Overview CB-Ratios	Noise source to which the measure applies	Augsburg	Munich	Nuremberg	Essen	Düsseldorf	Malmö	Bucharest	Bratislava	Helsinki
Noise proof window campaign	Roads Rail	1:11	1:8	1:14	1:25	1:18	1:15	-	-	-
rehabilitation of roads/low noise road surfaces	Roads	1:4	1:16	1:21	1:10	1:8	-	1:3	1:10	-
Speed reduction (speed limits)	Roads	1:119	1:335	1:301	1:112	-	-	-	-	-
Speed control (enforcement)	Roads	1:14,335	-	-	-	-	-	-	-	-
re-distribution /reduction of number of heavy trucks	Roads	-	-	-	1:6321	-	-	-	-	-
Barriers/walls	Roads	-	1:0.3	-	-	1:5	-	-	1:7	1:1.2
Embedded tracks for trams	Light rail (tram)	-	-	1:6	-	1:3	-	-	-	-

Overview CB-Ratios	Noise source to which the measure applies	Augsburg	Munich	Nuremberg	Essen	Düsseldorf	Malmö	Bucharest	Bratislava	Helsinki
Acoustical grinding of tracks	Rail / tram	-	-	1:74	-	-	-	-	-	-
Vegetated tram tracks	Light rail (tram)	-	1:1	-	-	1: 1	-	-	-	-

Administrative costs at EU level

In addition to the costs incurred at Member State level, the costs of administration, reporting, research and evaluation at the supra-national level (i.e. by the European Commission, European Environment Agency and Joint Research Centre) also need to be taken into account.

The costs (undiscounted) incurred to date (2002-2015) for each of the implementing authorities at European level are shown in the table below:

Table 3.28 - Costs of END implementation at supra-national level

	Staffing costs	Other costs (e.g. of meetings, missions, etc.)	Total costs
European Commission's DG ENV[159]	2,112,000	462,000	2,574,000
European Commission's Joint Research Centre (est.)	not provided	not provided	93,333
European Environment Agency	not provided	not provided	1,694,000

Aggregate assessment

Combining the information on administrative costs incurred at the EU level and the extrapolated values derived from the test cases, it is possible to provide an indicative assessment of the overall efficiency of the implementation of the END. The overall findings in the base case are summarised in the table below. The costs incurred at EU level relate to the discounted costs associated with administration, management and monitoring of implementation of the END by the European Commission's DG ENV and the European Environment Agency. While the Joint Research Centre is part of the European Commission, this information was available separately and therefore has been presented as such.

The present value costs for each of major airports, major roads and major railways encompass both administrative costs (at MS level) and costs of measures. These costs also account for the status of NAP implementation (i.e. differentiating between those Member States who have completed, or at least partially completed their NAPs and those

[159] Note that costs here exclude the costs of the Joint Research Centre (JRC) which is part of the European Commission. These are presented separately below.

who have not). A summary of the assumptions governing the level (%) of attribution of the total estimated costs and benefits in each of the base case (central), worst case and best case scenario are set out in Table 3.30.

Note that aggregate cost-benefit ratios have not been calculated for agglomerations as the test cases did not provide a sufficiently representative sample from which to extrapolate. However, the test case data and the cost-benefit analyses for a range of typical measures employed in agglomerations (see Table 3.27), suggest that the benefits of measures to reduce noise in agglomerations substantially outweigh the costs although the ratios vary significantly between measures.

Table 3.29 - Aggregate assessment of costs and benefits at the EU scale under the base case (most likely) scenario

	Total present value costs (€, million)	Total present value benefits (€, million)	Net present value (€, million)	Cost-benefit ratio
Administrative costs incurred at EU level	3	-	-	-
Major airports	438	2,854	2,416	1:7
Major roads	667	24,248	23,581	1:36
Major rail	82	7,317	7,235	1:89
TOTAL	1,190	34,418	33,228	1:29

Table 3.30 - Percentage of costs and benefits attributed to END in each scenario for major airports, major roads and major railways given Member States' status in terms of pre-existing noise legislation and NAP completion

	% costs and benefits attributed to END					
	Worst case scenario		Base case (central) scenario		Best case scenario	
	Costs	Benefits	Costs	Benefits	Costs	Benefits
No pre-existing legislation; NAP submitted/underway	100	50	100	100	100	100
No pre-existing legislation; no NAP	25	25	25	25	25	25
Pre-existing legislation; NAP submitted/underway	50	25	50	50	50	100
Pre-existing legislation; no NAP	50	25	50	50	50	100
Cost / benefit values	Low		Central		High	

Note that the benefits (and costs) are assessed over a 25-year assessment period and the analysis assumes that the same level of benefits will be delivered year-on-year from the time the expenditure on measures was made until the end of the assessment period. Shortening the assessment period, and thus the flow of benefits relative to the costs, will substantially reduce the Net Present Value (NPV). For example, if the assessment period were reduced to 18 years such that the effects of measures only endure for 5 years after the final year of investment, rather than the current 12 years, the NPV for major rail in Austria almost halves. It is likely that, at least in some cases, reducing the flow of benefits would result in negative NPVs and cost-benefit ratios.

Under the assumptions used in the base case scenario, the aggregate cost-benefit ratio (i.e. at the EU-level), excluding agglomerations, is 1:29. This implies that every €1 invested in efforts to address noise issues across the EU, yields around €29 worth of benefits. However, it is important to recall that the cost and benefit estimates are partial (they do not cover every single measure identified in NAPs), the benefit estimates are understated (they only account for highly annoyed and highly sleep disturbed populations) and the extent to which costs and benefits of measures can be attributed to the END is unknown.

Notwithstanding these limitations, the outcomes suggest that the END is efficient overall when the benefits of measures implemented to reduce noise levels are considered. The NPV is positive under all scenarios (base case, best and worst case) and only negative for airports and roads under the worst case scenario.

The corollary of this is that if the END did not exist, it can be assumed that some noise mitigation measures would still go ahead anyway because measures identified in NAPs were driven by national regulations or there were other primary regulatory drivers, such as introducing speed limits to help reduce pollution and comply with air quality limits. However, at least some measures would not have been identified and / or already implemented had it not been for the existence of the END. There would therefore have been a higher number of exposed persons to environmental noise, with significant implications for the health and well-being of those affected by noise as a result.

The worst case scenario (see table below) is modelled using the highest cost estimates and the lowest benefit estimates where the benefit estimates are in turn based upon the low values for the disability weights, VOLY and assuming that only 25% of the benefits can be attributed to the END in the case that noise legislation within the MS pre-dated the introduction of the END. The benefits are, however, understated (for the reasons cited above) and thus the probability of such a situation actually arising is considered to be low and, for airports at least, the benefits may at least equal the costs.

Table 3.31 - Aggregate assessment of costs and benefits at the EU scale under a worst case scenario

	Total present value costs (€, million)	Total present value benefits (€, million)	Net present value (€, million)	Cost-benefit ratio
EU level	3			
Major airports	438	276	-161	2:1
Major roads	28,961	5,971	-22,989	5:1
Major rail	1,417	2,238	820	1:2
TOTAL	12,426	9,471	-2,955	1:0.76

In contrast, the best case scenario is modelled using the low cost estimates and high benefit estimates and assumes that 100% of the calculated benefits can be attributed to the END except for those MS in which there was no noise legislation prior to the introduction of the END and where no NAP has been published. As may be expected, under the best case scenario, both the NPV and cost-benefit ratios are positive (see Table below), with a return on investment of approximately €327 for every €1 spent (excluding agglomerations). However, under a worst case scenario, only expenditure on measures to reduce noise from railways yields a positive NPV and cost-benefit ratio.

Table 3.32: Aggregate assessment of costs and benefits at the EU scale under a best case scenario

	Total present value costs (€, million)	Total present value benefits (€, million)	Net present value (€, million)	Cost-benefit ratio
EU level	3	-	-	-
Major airports	438	4,915	4,477	1:11
Major roads	38	126,540	126,503	1:3341
Major rail	3	26,004	26,001	1:9474
TOTAL	481	157,459	156,977	1:327

3.2.4.8 Conclusions - efficiency

Since it is not possible to assess the END's efficiency through a straight forward input-output relationship (for reasons explained at the outset of the efficiency section (see "methodological issues in assessing the efficiency and cost-effectiveness of the END"), efficiency has instead been assessed by means of a cost-benefit analysis (CBA) that includes the costs and benefits of measures identified in NAPs to reduce harmful levels of noise.

However, stakeholders have different opinions as to whether noise management measures should be factored into the CBA of the END, since these are not a specific requirement of the Directive. A strict assessment of the efficiency of the END would therefore be limited to a comparison of the direct compliance costs (i.e. noise mapping, preparation of action plans and reporting) and the qualitative benefits that arise from these activities (e.g. raising awareness of noise as an issue, generating large and consistent datasets on noise (through SNMs) that are valuable for advancing research on the effects of noise on health and productivity, and supporting actions in other areas (e.g. development of technical standards, emission levels and other Directives) that have a positive effect on noise levels.

Stakeholders generally agreed that the magnitude of benefits from END implementation should increase over time, for instance in terms of the utility of data collected at EU level as this becomes more comparable through the implementation of CNOSSOS-EU (which will be voluntary in R3 and mandatory in R4 It is not possible to quantify these benefits in monetary terms and therefore the assessment was extended to account for the implicit objectives of the END, i.e. to reduce exposure to noise, by considering the costs and benefits of noise reduction measures.

- Whilst assessing the cost-effectiveness of individual / groups of measures in NAPs will provide useful cost-benefit data, it should be recalled that this can only be considered as an indirect indication of the END's efficiency, because the END only requires the drawing up of a NAP but does not formally require measure implementation (even if this is implicit).
- Measure-level costs and benefits could therefore be classified as indirect costs (and benefits) rather than direct compliance costs. Nevertheless, establishing cost-benefit ratios at the measure level is useful in order to help persuade MS of the scale of benefits of implementing expenditure measures relative to the costs and to the evaluation question as to how far the END has contributed to reducing the problem of environmental noise by 2020.
- The costs of implementing noise abatement, mitigation and reduction measures identified in NAPs as part of noise management are likely to significantly exceed the administrative costs of complying with END, particularly since in many MS, the latter have declined between R1 and R2, since there are no longer the initial one-off costs associated with introducing new EU legislation.

- Overall, the END appears to be cost-effective in that the benefits are likely to outweigh the costs over time. However, there are problems in assessing the benefits at this early stage of measure implementation, given the long-term nature of many noise mitigation programmes and measures.
- Whereas the costs of many noise mitigation and abatement measures arise in the early years of measure implementation but may extend over the full implementation lifecycle, the benefits arising may only fully materialise after the end of the implementation and are likely to extend for many years into the future.
- The percentage of R1 NAPs that include "fully implemented" measures at this stage in the END implementation lifecycle is relatively low. This could arguably be expected as the NAPs are outlining a course of action to address noise over the coming 5 years, and many measures extend beyond a single round into the subsequent round.
- The implication of this for the CBA extrapolation work to the EU level is that it is difficult to know how many measures were actually implemented across the EU-28 since no systematic monitoring of whether measures in NAPs are partially or fully implemented, or not implemented at all, is carried out. Some measures are identified in the NAPs as already underway or completed, while others are only planned.
- There appears to be a favourable benefit-cost ratio for most types of noise mitigation measures, but there is considerable variation in the level of benefit, depending on whether a worst-case or best-case scenario is applied.
- As noted earlier, the level of benefit is strongly dependent on discounting to take the extent of attribution into account. Determining an appropriate attribution ratio is not straight forward due to the particular nature of the END, which is dependent on MS implementing measures at national, regional and local level through NAPs but using national funding sources. There is a perception that many measures have at least some form of national dimension, and some measures may pre-date the END.
- Although the benefits will only be realised in full after 2017, it is not uncommon that the cost curve in implementing new legislation is centred on the initial stages of implementation (including one-off costs) whereas the benefits of bringing about a common, harmonised approach to noise mapping through a common assessment method will only fully materialise over the longer term.
- The administrative costs of END implementation have typically declined considerably in R2 compared with R1. This was found to be partly due to the economic crisis and associated budget cuts, but equally due to one-off, upfront costs of END implementation, which tend to be higher than recurring costs such as the procurement of external technical expertise to produce Strategic Noise Maps and other technical support from consultants.
- The reporting mechanism for SNMs – set up by the EEA in close conjunction with the EC - was generally regarded as being efficient and effective, although the quality check by the EEA could perhaps be extended to include NAPs.
- It is difficult to draw strong conclusions about the cost-benefit ratio of the END at EU level based on test case estimates.
- While the test case findings suggest that the benefits of END implementation exceed the costs of measures for all noise sources, and under a range of scenarios, the costs and benefits per person vary significantly and will depend on a number of factors including population density, background noise levels, traffic composition and the degree of maturity in addressing noise issues (which in turn will influence the selection of measures and background noise levels).
- Taking account of the data limitations and the assumptions applied, the total present value costs (including costs of implementation linked strictly to the END as well as costs of measures) across the EU-28 (excluding agglomerations) range from around €480 million to €30.8 billion over a 25-year period while the total present value of

benefits (again excluding agglomerations) range from around €8.5 billion to €157 billion.

- Although it was not possible to evaluate the efficiency of END implementation in agglomerations in the same way, the analysis of the relative costs and benefits of a number of typical measures suggests that the benefits of END implementation are likely to significantly outweigh the costs even though the cost-benefit ratios vary widely between measures. For example, the of noise barriers along roads in Munich appear to exceed the benefits by a ratio of 1:0.3, while speed enforcement measures on sections of roads in Augsburg have very low costs in relation to the benefits with a cost-benefit ratio of 1:14,335. Overall, and on the basis of the available information, measures to reduce the speed of road traffic and to reduce the numbers of heavy road vehicles in agglomerations appear to be the most cost-effective.

More broadly, there are several key lessons learned from this study relating to how to **improve the assessment of the efficiency of the END in future evaluations**. These are summarised in the Box below and are important to keep in mind in reviewing the section on the efficiency of the END:

Box 3.8 - Assessing the efficiency of the END – lessons learned through the evaluation

- Since measures are not obligatory, but only voluntary, this raises a question as to whether the most appropriate way to measure the Directive's cost-effectiveness is through a measure-based approach.
- Not all NAPs include spending measures and where these are included, they may not be sufficiently detailed to allow for a reliable estimation of the associated benefits.
- There are many NAPs across EU-28 where measures may have gone ahead, but there is no reliable data on these. This raises an issue as to the need to strengthen monitoring and reporting as to whether measures identified in NAPs have actually gone ahead (and if yes, which measures and whether this was in full or partially).
- Evidence was identified during the selection of suitable NAPs for the case studies, no spending measures have actually take place at all yet in the case of many NAPs, especially within agglomerations, where local authorities often do not have either the budget or the decision-making and spending powers to go ahead with measures identified.
- Stakeholders also emphasised that qualitative factors should also be taken into account in assessing cost-effectiveness, not least because many of the benefits of the END are not possible to quantify, such as promoting a more strategic approach to environmental noise management, encouraging joined up working across different Ministries on noise at receiver-related issues across different policy areas and sources.

3.2.5 European Added Value (EAV)

The assessment of European Added Value (EAV) considered how far the END has added value and contributed to the achievement of objectives over and above what could have been achieved at national level alone. The counterfactual, i.e. what would have happened in the absence of the END, and what would happen if the END were to be repealed in future, was also considered.

3.2.5.1 Overall European Added Value of the END

Introduction

The added value of a European approach to the management of environmental noise is linked to the issue of the different competences of the EC and MS respectively. To recap, whereas the MS have competence for tackling environmental noise at receptor and for END implementation at national level, in line with subsidiarity principles, the EC is responsible for ensuring the effective coordination of END implementation and for monitoring, reporting and data collection. In addition, the linkages between EU-level data collection on population exposure through noise mapping within the END and informing European noise at source legislation should also be recalled.

Among the implications of implementing the END under subsidiarity are for instance that the Directive does not set limit values at receiver, but instead leaves the decision as to whether to set binding or non-binding LVs to the discretion of the MS, who are also responsible for enforcement, wherever these are binding.

3.2.6 EQ14 - What has been the overall EU added value of the Environmental Noise Directive?

In assessing this EQ, it has been important to compare the baseline situation before the END was adopted with the situation now. In this regard, among the sub-questions that were analysed are:

- **EQ14a -** To what extent did EU Member States have environmental noise legislation in place to address noise at receptor prior to the END?
- **EQ14b -** To what degree were EU MS already carrying out noise mapping prior to the END and how far were mitigation measures already in place? Have these been continued under the END and if yes, on the same scale, a lesser or greater scale?
- **EQ14c -** If particular MS already had mitigation measures at receptor in place, how far, if at all, has there been a change in the level of attention among policy makers and politicians, the budget allocated and types of measures being supported?

The above issues are now examined in further detail.

EQ14a - To what extent did Member States have environmental noise legislation in place to address noise at receptor prior to the END?

Firstly, the END has added value by putting in place a common legal framework across the EU. Many MS did not have national environmental noise legislation prior to the adoption of the END, and its transposition into national legislation. Several respondents to the online survey pointed out that the revision and adoption of Annex II encourages commonality between national approaches while still respecting the principle of subsidiarity.

In many new MS (e.g. **EE, LV, LT, RO, SK and SI),** the existence of an EU Directive on environmental noise has added value, since the transposition of the Directive into national legislation represented the first time that there was environmental noise legislation requiring noise mapping and action planning. Although some MS already had

some form of environmental noise regulation (sometimes even stemming back to the Soviet period e.g. in Lithuania), in other MS, the development of national implementing legislation transposing the END was the first time there was any national legislation on environmental noise (see Section 2.3.2 Pre-existing legislation - where a more detailed assessment of the legal baseline situation is provided).

This has resulted in environmental noise being put on the domestic political agenda for the first time, or at least increasing its perceived importance. The Directive has also made a significant positive contribution by **raising awareness among national, regional and local policy makers, politicians and the wider public** about the nature and extent of the problem. This was considered particularly important by some stakeholders against the background of budgetary cuts following the financial crisis which made it harder for policy makers to 'ring-fence' environmental budgets. Moreover, the data collected as a result of the END enables prioritisation of the most cost-effective measures.

There are however quite a number of EU MS whose noise legislation dates as far back as the 1970s, 1980s and the 1990s (**i.e. DE, DK, FI, FR, IE, IT, LU, NL, PL, PT and the UK)**. A minority of stakeholders in these MS maintained that value added has been limited with regard to noise mitigation since national legislation on environmental noise already required some mitigation and reduction initiatives. However, most interviewees acknowledged that the main benefit of the END was in promoting a more "common approach", in particular to noise mapping using common assessment methods.

The requirement to produce SNMs using the L_{den} and L_{night} indicators was recognised as having helped to make population exposure data more comparable in Europe. A stakeholder in Germany from an NGO commented in relation to the END's added value that "European Added Value is especially high for MS which did not have a corresponding national policy.

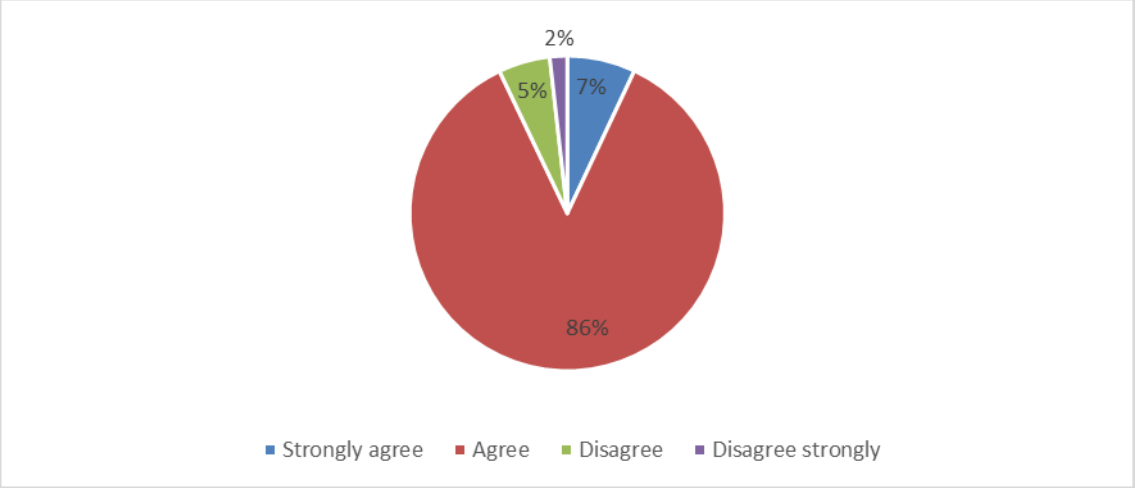
But even for MS that already had a well-developed national noise control policy, there are considerable improvements due to the implementation of the END". Among the examples cited where the END has made a difference compared with the pre-END national approach was in **strengthening information availability to the public**. The NGO commented that "Art. 9 of the END has contributed considerably to strengthening awareness about noise. Noise nowadays gets a lot more attention in the media. Citizens participate in discussions on NAPs. For instance, in Berlin 3,000 proposals from citizens contribute to the preparation of the Noise Action Plan 2013 and the draft NAP of Sept. 2012 for Frankfurt Airport received 11,000 statements from the public.

Moving towards a common approach based on common noise assessment methods is an inherently European endeavour. The majority of stakeholders interviewed agreed that a common approach facilitates the ongoing monitoring of the effects of existing source legislation with a view to their possible revision in future. This would not be possible through a purely national approach since noise maps and population exposure data need to be produced on a common basis to ensure that comparable data is available to EU policy makers. Since almost all stakeholders agreed that source legislation has equal, if not greater potential to reduce high levels of environmental noise compared to legislation dealing with noise at receptor, it was acknowledged that the END was crucial.

Whilst prior to the END, some MS already produced noise maps, they used different noise indicators to do so across different transport sources and differences in the metrics were utilised between MS. The baseline situation before the END is examined in further detail later in this section.

The results from the online survey confirm that most stakeholders perceive the END as demonstrating strong EAV. Overall, 86% of respondents to the survey of public authorities agreed with the statement that the Directive has added value to what MS were already doing (and 7% strongly agreed), whilst only 7% disagreed (or disagreed strongly).

Figure 3.12 – To what extent do you agree with the statement that the Environmental Noise Directive has added value to what Member States were already doing? (n=57)

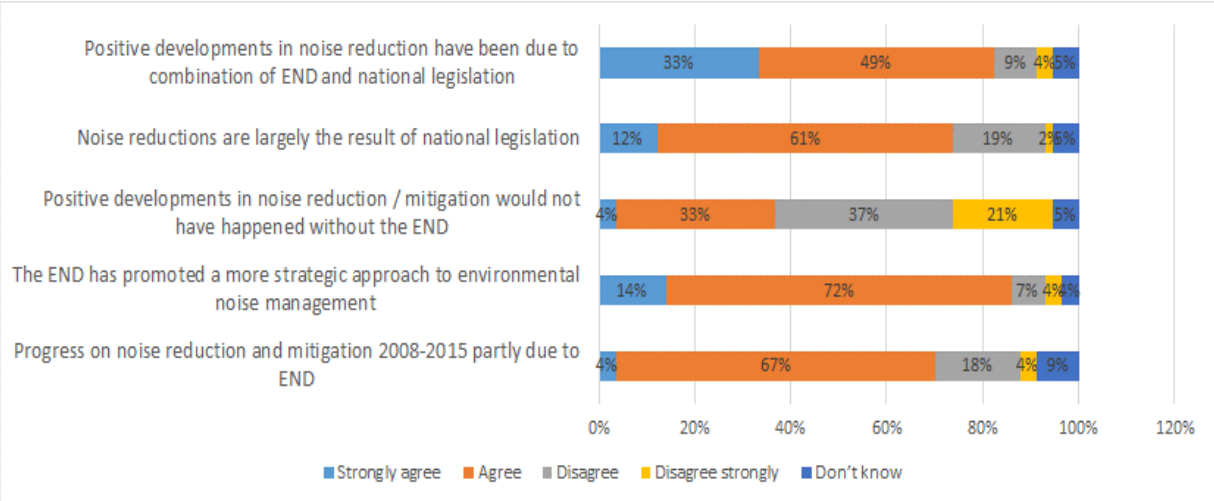


Source – Online survey of public authorities

Most participants agreed that the END in combination with national legislation has triggered positive developments in noise reduction. However, 61% of respondents agreed and a further 12% strongly agreed that progress in noise reduction was primarily the result of what EU MS were already doing rather than EU legislation in the field of environmental noise.

The interview programme found that the small number of stakeholders that were less positive about EU value added tended to be from MS where there was already existing legislation before the END. A similarly high percentage of respondents acknowledged that the END had at least partially contributed to noise reduction.

Figure 3.13 – Please rate the extent to which you agree with the following statements (n=57)



Source – Online survey of public authorities

Whilst acknowledging that considerable progress has been made towards a common approach at European level, many stakeholders commented that the timescale for its implementation is longer than they originally anticipated. A common expectation among interviewees was that the revised Annex II would be implemented by R3 but Commission Directive (EU) 2015/996 will not in fact be implemented across EU-28 until R4.

As noted earlier, the additional 5 year timeframe means that whilst data produced on a fully common basis will be available in R4, fully comparable noise exposure data produced using the CNOSSOS-EU methodology under the revised Annex II *between Rounds* will only be available in R5). The full value added of the END will only be manifested over the medium term. However, many stakeholders interviewed stressed that the progress already made in collecting EU-level data should already be good enough to inform source legislation. This was reiterated by several stakeholders at the validation workshop held in September 2015.

The EAV of a "common approach" to strategic noise mapping based on common assessment methods was however questioned by a few stakeholders. Some MS will continue using their own noise mapping methods in addition to CNOSSOS-EU and this may lead to confusion amongst the public (raised by a CA in **Belgium** responding to the online survey, but also by the CAs in **Denmark** and **Sweden**, who have decided to continue using the Nord2000 method for national reporting purposes, in parallel with the revised Annex II.

Through the interview programme, further feedback was obtained which found that the END has generated EAV in a number of ways, for instance by:

- Providing an important input to establishing baseline data on population exposure across 5dB thresholds, and ensuring longitudinal monitoring of changes in population exposure on a five yearly basis. This was viewed as being crucial to informing the development of new, and the revision of existing source legislation.
- Harmonising noise metrics through the use of the L_{den} and L_{night} indicators;
- Raising awareness among the public and putting environmental noise on the policy agenda in EU MS that did not previously have noise control legislation.
- In EU MS that already had noise legislation, awareness among the public has still been raised significantly in some MS, since public information accessibility was less of a priority in national legislation, pre-END, with a lack of universal access to those limited noise maps produced.
- Raising the visibility of environmental noise issues in other policy areas, even in countries where there was existing legislation, due to the fact that action is more likely to be taken when a European Directive has been put in place;
- Higher political attention to environmental noise, with additional (external) pressure on national governments to produce action plans and to implement measures to tackle noise. Several examples were provided where it was politically easier to increase expenditure on noise mitigation and abatement thanks to the existence of EU legislation; and
- Introducing a degree of accountability and benchmarking as to what national authorities are doing to mitigate noise

EQ14b - To what degree were EU Member States already carrying out noise mapping prior to the END and how far were mitigation measures already in place? Have these been continued under the END and if yes, on the same scale, a lesser or greater scale?

The evaluation research also examined the baseline situation across the EU prior to the END by transport source, in particular, whether noise mapping already took place, and if so, which metrics were used and whether national computation methods for assessing noise had already been developed prior to the END. This was useful in shedding light on how far the END has made a difference compared with what national policy and regulatory actions were already taking place.

Baseline situation vs. current situation

(i) Baseline - noise assessment methods

With regard to **noise assessment methods**, prior to the END's adoption in 2002, there were several **different national computation methods** which did not allow for an EU-wide comparability of data. Several examples are mentioned in the analysis below, whose purpose is not to provide an exhaustive mapping of the historical evolution and use of national methods in different countries, but rather to highlight the fact that there were many different national-specific approaches in place prior to the END.

During the early years of the Directive's implementation, MS that previously had no national computation methods used a number of different interim computation methods[160] in the period leading up to the development of CNOSSOS-EU for the determination of L_{den} and L_{night} for road traffic, railway noise, aircraft and industrial noise respectively. The END has introduced a common, harmonised approach through a complex and technical process of ensuring that CNOSSOS-EU reflected technical and scientific state of the art in noise assessment methods by source, and that interim methods used during the initial period of END implementation had national equivalence.

In particular, the END has required MS to **carry out technical work to convert national noise calculation methods by transport source to reflect the common European L_{den} and L_{night} END indicators.** For instance, in the **UK**, technical studies were undertaken to ensure that existing noise calculation methods and indicators used for assessing road noise were converted into those set out under the END[161]. Similarly, in **Denmark**, prior to the END, noise mapping across all sources was only calculated based on noise exposure as LA_{eq}, i.e. 24-hour equivalent values. In order to implement the Directive, national guidelines were adopted and L_{den} and L_{night} were then used for the preparation of the noise maps.

A clear added value of the END is that it has helped to **harmonise metrics across the EU for each type of noise source**. When the END was adopted, this was expected by noise stakeholders to be a positive aspect of the END compared with existing national approaches. The interview and workshop feedback suggests that using common indicators to produce data on a common EU-wide is indeed widely accepted as a benefit and added value of the Directive, albeit one that will take time to fully be realised.

[160] EC Recommendation of 6 August 2003 concerning the guidelines on the revised interim computation methods for industrial noise, aircraft noise, road traffic noise and railway noise, and related emission data.

[161] Converting the UK Traffic Noise Index L10,18h to EU Noise Indices for Noise Mapping, TRL Project report PR/SE/451/02, 2002; and Defra, Method for Converting the UK Road Traffic Noise Index LA10,18h to the EU Noise Indices for Road Noise Mapping, st/05/91/AGG04442, 24th January 2006.

(ii) Baseline – extent of mapping and noise mitigation measures across different transport modes

The 'baseline situation' across different transport modes in terms of whether noise maps were produced and mitigation measures were in place prior to the END is now considered. The baseline situation has been defined for the purposes of this study as pre-2002 in general, but pre-2007 in the case of R1 noise maps, and pre-2008 in the case of R1 NAPs.

In EU countries that already had national legislation regulating aircraft noise and noise from airports prior to the END, some **major airports** already produced noise maps prior to the END. However, according to some stakeholders, the reason that some countries carried out noise mapping of airports was that airport operators were required to submit noise maps as part of planning applications for airport expansions to meet passenger growth. Noise maps were also produced pre-END in some EU countries to meet national regulatory requirement and/ or to provide factual information for the purposes of discussions with local communities about the nature and extent of the problem, and where noise insulation schemes were in place.

However, the **noise maps that existed pre-END were prepared using different metrics**, and indeed, some national indicators continue to be used for national policy-making and reporting purposes alongside L_{den}. For instance, in the **UK**, noise maps for airports were produced prior to the END using 57 dB L_{eq} contours to assess noise annoyance. The Department for Transport developed a methodology in the mid-1980s based on the findings from an expert study for assessing the current and future impacts of aircraft noise by determining the area exposed to average sound levels of 57dB(A) or more between 7am and 11pm. However, this indicator was viewed by NGO stakeholders interviewed as not measuring noise exposure sufficiently accurately.

Nevertheless, the Aviation Policy Framework (APF) in the UK states that the Government 'will continue to treat the 57dB LA_{eq},16h noise contour as the average level of daytime aircraft noise marking the approximate onset of significant community annoyance'. It also recognises that 'this does not mean that all people within this contour will experience significant adverse effects from aircraft noise', 'nor does it mean that no-one outside of this contour will consider themselves annoyed by aircraft noise'.

For reporting purposes under the END, noise maps for airports must now use L_{den} when drawing up noise maps. According to interviews with several NGOs, the fact that SNMs are produced using common noise metrics across the EU is beneficial since it was viewed as more accurately reflecting actual experiences of noise levels experienced by communities, thus adding value to what had been done in the UK prior to the END. Some airport operators interviewed also stated said that they accepted the common reporting requirement using the L_{den} indicator and that there were advantages in everyone using the same indicators across the EU.

Whilst many major airports already had some form of noise mitigation and abatement measures in place before the introduction of the END, this was usually done ad hoc or in piecemeal fashion rather than through a systematic action planning approach. Although many airports already engaged with communities on environmental noise prior to the END (especially in countries that already regulated aircraft noise such as Germany and the UK), the fact that there is a formal requirement to inform the public and to make information accessible across all 28 EU MS was viewed as being positive. A major airport operator in the UK commented that action planning was a useful discipline in itself, given its five yearly cycle for reporting back internally to management and different divisions as well as externally to the local community and wider stakeholders on their activities

Turning to **major roads,** some countries undertook noise mapping prior to the END. For instance, the Portuguese Noise Pollution Act of 2000 requires the national road authority, the IEP (Instituto das Estradas de Portugal), to produce noise maps in respect of major roads. The decision to produce noise maps in **Portugal** was to anticipate the planned introduction of future EU legislation[162]. In a number of other countries, different methods for carrying out noise mapping were also developed before the END, such as the Nord 2000 model for mapping noise for major roads and major railways in **Denmark**[163]. Noise maps also produced in France prior to the END (see French national computation method **'NMPB-Routes-96 (SETRA-CERTU- CERTULCPC-CSTB).** In the **UK,** work took place much earlier than the END to develop calculation methods for assessing levels of road traffic noise through the CRTN method in 1988[164], which replaced an earlier 1975 version, even though strategic noise maps were not produced until later.

A further issue examined was whether there were already any strategic action planning type approaches in place prior to the END with regard to road noise. In most EU countries, environmental noise was already being considered, but has become more visible in road transport planning and in strategic policy making post the END.

For instance, in **Denmark,** prior to the Directive being fully implemented (since the first NAPs were not produced until 2008), a Road Noise Strategy was adopted in 2003, which runs until 2020. This had already triggered the development of municipal noise mitigation plans and the adoption of noise-reducing asphalt. The Environmental Protection Agency has set recommended limit values for noise from road traffic in connection with planning and projecting of new residential areas along busy roads and new constructions or renovation of existing major roads have to be insulated to mitigate noise pollution. The Road Noise Strategy was evaluated in 2010. The evaluation showed that most government initiatives had been implemented or were being implemented.

However, even after implementation of many measures, as many as 785,000 homes were still affected by road noise above the recommended limit value – almost one in every three homes in Denmark. This example shows the **difficulty in clearly identifying measures that were put in place pre-END and those that are explicitly due to the END.** Many national measures are part of a continuum, given the long-term nature of transport infrastructure planning and noise mitigation and abatement measures.

As far as **major railways** are concerned, the RMR noise computation method in the Netherlands was developed in the mid-1990s, prior to the END, and was identified in the EC Recommendation of 2003 as the main recommended interim method. Other examples of national computation methods that pre-date the END include the Nordic Rail Prediction Method for Trains (1996) and the Calculation of Railway Noise 1996 (UK).

However, generally speaking, before the END was adopted, there was much less noise mapping of railways compared with other transport sources. This partly reflects the differing baseline and the lack of national regulation of railway noise in most EU countries. An exception was in **Austria,** where noise maps were used to assess the effectiveness of pre-existing noise protection measures for the reduction of noise from railways under the *Ordinance for the Protection from Noise from Railways*. The objectives and measures of such pre-existing and ongoing programmes for noise control have been integrated into action plans developed under the END.

[162] http://www.conforg.fr/internoise2000/cdrom/data/articles/000865.pdf

[163] Traffic Noise prediction with Nord2000, Danish Ministry of Transport.

[164] Department of Transport publication, 'Calculation of Road Traffic Noise (CRTN)', 'Department of Transport – Welsh Office, HMSO, 1988 ISBN 0115508473;

An interviewee in the railways sector in **Ireland** suggested that there was less interest in noise mapping or action planning in railways historically because in many countries, the railway infrastructure network was already developed decades ago without many new tracks being installed which could have caused concerns among nearby residents. Moreover, the level of train passages per year varies a lot less than the level of vehicle passages per year for major roads and aircraft movements in major airports. It was posited that there was historically less pressure on national railways to produce noise maps since there was less affected population. However, the situation has changed partly because the END came into effect making noise mapping obligatory and also due to the increased number of complaints about railway noise, reflecting land-use trends towards allowing more residential housing to be built in closer proximity to railways than was the case pre-END.

In terms of noise mitigation and abatement measures pre and post the END, before the END was introduced, only a few countries, such as **Germany** and **Austria,** had national mitigation measures in place. However, since the END was adopted, such measures have continued, reflecting their long-term nature. For instance, as shown in the following example, many programmes to mitigate railway noise require a commitment of 20-30 years, for instance, to address rolling noise and retrofit wagons. They also require significant investment over time, rather than a one-off budget allocation.

Box 3.9 Reducing railway noise in Germany – a 25 year programme

In **Germany**, a national action programme to reduce railway noise was already in place to reduce noise prior to the END through the German railway Deutsche Bahn (DB). The long-term goal is to cut rail noise emissions between 2000 -2020 by half, i.e. a noise reduction of 10 dB(A). Some measures came into effect well before the END, including tackling noise at source. For instance, new cars purchased by DB Schenker Rail since 2001 come equipped with another type of quiet brakes, K brake blocks.

However, other measures are more recent and have been mentioned in NAPs, even if they are regarded as national measures. For instance, in June 2013, DB approved the conversion of freight wagons to use LL brakes (quiet brakes that can be installed in existing vehicles). All old freight cars are being retrofitted with quieter brake blocks, which reduce the rolling noise of wagons to half that of conventional cast iron brakes. The estimated cost of a national programme to reduce railway noise by half was €100m per year for the duration of a 25 year noise-reduction programme. The potential total costs of measures for retrofitting alone are €300m to convert the 180,000 wagons that are eligible to be retrofitted with new, quieter brakes. The current number of wagons retrofitted is only 6,350.

Similarly, there is also a **problem in differentiating between measures that are national and those that have a European dimension** and are seen as having taken place as a result of the END. It is often difficult to / identify a precise division point between measures that pre-date the END and ongoing measures implemented in R1 and R2 since many measures are of a long-term nature.

In the **Netherlands**, for instance, in the railway sector, noise abatement legislation has been in place since 1987. Some mitigation measures were already in place prior to the END. However, END implementation has also coincided with greater levels of investment in rail noise mitigation and reduction. In 2008, for instance, noise differentiated track access charges were introduced. The bonus is fixed at € 0.04/ wagon-km and is applied to both passenger and freight vehicles with a maximum of € 4,800 over two years. Studies and pilot projects have been launched to test composite brake blocks and noisy trains will be prohibited from 2015.

Within **agglomerations,** before the END, most countries did not produce noise maps for agglomerations as an administrative unit, since there was no common definition of what constitutes an agglomeration, which was interpreted differently in different EU countries. However, some cities did produce noise maps using a variety of national-specific

metrics. However, momentum towards noise mapping in urban areas was found to have been largely prompted by the END.

As noted under road noise, in **Portugal**, the Portuguese Noise Pollution Act of 2000 required local authorities to draw up noise maps in in large urban areas. Prior to the END, in **Greece,** the Ministry of the Environment prepared noise maps for all cities in Greece with populations with more than 50,000 For Athens, information from the early 2000s suggests a noise map was prepared every 10 years: 1977, 1987 and 1997.

A 2007 map was not prepared however due to the introduction of the END. These were based on data and information provided by the Greek National Statistical Census Bureau (for example, building block maps, the number of residents per building block, etc.) and parameters such as L_{max}, L1, L10, L50, L90, L95 and L_{eq} were measured. L_{den} and L_{night} L_{den} and L_{night} calculations required under the END were not undertaken and therefore the noise maps prepared as part of R1 (2006) were developed using different assessment tools.

With regard to mitigation measures within agglomerations, in some countries, there were already measures in place to tackle noise prior to the END, but the END promoted a more integrated and systematic approach to noise mitigation and abatement that covers several transport sources as well as industrial noise.

The END has also added value by **strengthening information accessibility to the public.** This has also promoted greater transparency, notwithstanding the challenge of encouraging more citizens to show interest in and download the noise maps. For example, in the **UK,** prior to the END, noise maps were only produced for airports and mapping was produced by the CAA. Noise mapping was not produced systematically for other sources. When it was produced for roads and for urban areas/ agglomerations, this was mainly because some Local Authorities needed specific local mapping/prediction results for local development control purposes. Although noise maps produced for airports were made available to the public, noise mapping results for other sources, if these were produced at all, were not made widely available.

Findings – comparing the baseline with the current situation

The END represents an important step forward towards a harmonised mapping approach using common metrics for the first time. Without the END, there may have been noise maps available which were useful for national, regional and local decision-making purposes, but there would not have been noise maps produced using common metrics across the EU and the requirement to provide statistics related to the affected population.

- Prior to the END, there were many different national noise indicators. Post-END, only two common indicators are in use (L_{den} and L_{night}), which has added value by enabling noise maps to be produced on a common basis using harmonised metrics across all EU MS;
- Prior to the END, there were many different national computation methods for assessing road traffic noise, aircraft noise, railway noise and industrial noise. The END has added value by bringing about a common approach to noise assessment methods through the CNOSSOS-EU process. Even if this has taken a long time to develop, reflecting the scientific and technical complexity, this will inform source legislation in a way that would not have been possible without the END;
- EU added value will however only be fully achieved once Commission Directive (EU) 2015/996 has been implemented and more comparable data is available to measure changes in population exposure between rounds.
- It is difficult to distinguish clearly between noise mitigation, abatement and reduction measures that pre-date the END, and those put in place after the END came into

effect. This is due to the long-term nature of many noise reduction measures, some of which take 20-25 years to implement.

- It is likewise difficult to distinguish between national measures and those that can be considered as having been implemented through the END. If measures pre-date the END, and have been continued, they are likely to be viewed as being national in character, although stakeholders recognised that through action planning, the END provides a framework through which nationally financed measures are implemented, where such funding is available.

3.2.6.1 Added Value of the END - measures implemented through NAPs

In the previous sub-section, we considered how far the END has brought about changes compared with the baseline situation. In this sub-section, a further issue related to added value is the extent to which once the END came into effect, with the first NAPs adopted in 2008, the measures implemented identified in NAPs went ahead specifically due to the END, or would have gone ahead regardless, for instance because:

- There were existing national legislative requirements;
- The measures were planned before the END was adopted because many noise reduction programmes include a series of measures over a 20-30 year time horizon; and
- There were other primary drivers, for instance in cases where environmental noise reduction was a secondary (but still important) objective for measures going ahead (e.g. when the primary driver was air quality, road safety etc.).

Among the feedback was that some stakeholders stated that many measures would have gone ahead irrespective of the END, because there were other primary drivers of measures (e.g. strengthening air quality, improving road safety, pre-planned infrastructure upgrades) that have important secondary effects in contributing to noise reduction.

In R1, for instance, stakeholders in several countries indicated that many measures were already planned before the END came into effect but were mentioned in R1 NAPs as END measures. Examples were identified for instance in the railways sector in **Austria,** and across all sources in **Germany,** where compared with other countries, there was greater scepticism among many stakeholders interviewed as to whether measures could be attributed at all to the END.

Since many measures are nationally-financed, it is perhaps not surprising that many stakeholders view **measures in NAPs as being of primarily national character, and only partially influenced by the END**, given that the function of noise action plans is to bring together measures and initiatives across many different policy areas (e.g. planning, public transport, road infrastructure development) into a single document. The added value from a national perspective, as explained earlier under impacts (see section 3.2.3.7 - Impacts of the END's implementation), is that action planning promotes a more strategic approach to environmental noise management. It does not necessarily change the types of measures being supported.

It is also important to note that an exclusive focus on the source of financing of measures risks underestimating the added value of the END, since it does not in itself foresee a budget for funding noise mitigation measures. As a consequence, measures will inevitably be funded at national level, but may nevertheless have been triggered by action planning as prescribed by the END.

The online survey asked respondents for views as to what percentage of measures were driven by national legislation and would thus have gone ahead anyway. The findings were that 38% of respondents stated that between 75% and 99.9% of actions had already been in the pipeline anyway and probably would have gone ahead without the

END. Another 20% confirmed this for between 50% and 74.9% of actions in their countries.

This shows that the added value of the END in terms of promoting new concrete actions and measures is somewhat limited, again reflecting the fact that NAPs only need to be drawn up but measures contained therein not necessarily been implemented. This was confirmed through the interview programme. In many cases (for example, in **DK, DE and in NL),** it was difficult for END stakeholders to distinguish clearly between measures that would have gone ahead anyway since they were already envisaged at national level to meet national regulatory requirements and measures that have been supported specifically because of the END as a direct consequence of the development of NAPs. This is however a matter of perception. Even though national legislation might be the original driver, the measures themselves are mentioned in NAPs so there is no reason why they cannot also be considered as directly contributing to the objectives of the END.

The END has added value by encouraging EU MS to implement measures identified in NAPs, although there remains a problem that in the view of some stakeholders that the legal requirements are not stringent enough to require MS to implement noise control measures or to tackle noise at source.

Looking overall, as commented by an acoustic consultant, one issue appears to be that "some MS have followed the letter of the law, whereas others have followed the spirit of the law". The absence of legal compulsion in respect of measure implementation may undermine the coherence between MS and the effectiveness of the END's implementation, since some MS are not tackling the problem actively at receptor through expenditure measures, whilst others are doing so.

While it is not compulsory to implement expenditure measures under the END, as detailed in Section 2.3.8 (Noise Action Plans), it is strongly implied under Art. 8 that action planning authorities should identify measures in their NAPs. The research showed that whilst some MS intended to implement measures, but have not done so due to budgetary limitations, others have implemented measures to tackle noise at source in R1 and R2. Examples of R1 measures that have been implemented were identified through the 19 case studies (see Appendix F – test case summaries).

In larger MS, such as **France, Germany** and the **UK,** there are different approaches to the identification and implementation of noise measures among different types of CAs and levels of governance (national, regional and local). In **Germany,** whilst there is typically a long list of measures is provided in NAPs, few measures have actually been implemented. The baseline situation should also be taken into account when assessing how far MS have invested in noise mitigation, abatement and reduction measures during R1 and R2 implementation.

Ireland mainly implemented non-expenditure measures in R1. However, it was noted that in respect of roads, the quality of the road network infrastructure is better than in many other EU countries. Before the END's adoption, during the economic boom, an interviewee stressed that significant investment had been made in developing a new motorway network in the 1990s. Since this was developed with quieter road surfaces than the comparable motorway networks in most other EU MS, which are typically much older, there has been less tendency to focus on quiet road surfaces.

In the **Netherlands**, for instance, the Dutch CA stated that even 13 years after the adoption of the END, noise-reducing measures tend to be implemented as a result of national legislation rather than the END. The same point was raised for instance in **Germany** and the **UK**, particularly in respect of noise regulations concerning airports. Even so, a number of public authorities interviewed (e.g. **Sweden**) stated that the END reinforces existing measures and initiatives at national level.

The question of EAV also raises the issue of **subsidiarity** – which activities are better carried out by individual MS and which should be undertaken either at European level, or with a stronger European dimension. The non-enforceability of noise-reducing measures under the Directive (Art. 1(c): "with a *view to* preventing and reducing environmental noise where necessary" [own emphasis]) implies that such enforcement is left to MS. This, according to some stakeholders (e.g. DK), makes it harder to assess the impact of the Directive since there is scope for flexible implementation by MS. For example, some MS have binding noise limit values while others do not (see also Section 2 - implementation report). The subsidiarity principle is also relevant when it comes to noise limit values and specific measures given the different perception of noise between the different cultures in Europe.

Similarly, there is also the view that the Directive's added value is diminished in the absence of an ultimate purpose, which a small number of stakeholders regarded as insufficiently defined. Overall, there is a clear affirmation amongst public authorities responding to the survey as to the added value of the Directive.

Ninety-three per cent of respondents agree with the statement that the Directive has added value to what MS were already doing. If measures pre-date the END, and have been continued, they are likely to be viewed as being national in character. Although some stakeholders recognised that the END provides an overarching framework through which environmental noise measures across different sources can be identified through an action planning approach, since these are implemented using national funding, it makes it more difficult to convince stakeholders that measures can be solely attributed to the END.

3.2.6.2 The EAV of the END through volume effects, scope effects, demonstration effects and process effects

A number of different types of effects have been identified through the research as part of the assessment of the END's EAV, such as: (1) Volume effects (2) Scope effects (3) Demonstration effects and (4) Process effects. These types of effects have been identified in previous evaluations to assess the EAV of EU policies and legislation. In the context of the END, the way in which these concepts might be interpreted is now explained:

Box 3.10 Typology of effects – the volume, scope, demonstration and process effects of the END

Volume effects – the extent to which the existence of the END may have had a catalytic effect in particular EU countries by increasing the funding allocated to environmental noise mitigation, abatement and reduction programmes and measures compared with equivalent national programmes prior to the END.

Scope effects – the extent to which the END may have encouraged greater consideration of environmental noise mitigation issues in national policymaking and in the design of relevant national, regional and local spending programmes directly related to addressing environmental noise at receptor and in other policy areas (e.g. transport, infrastructure development/ planning, urban development/ planning, air quality), wherever there is potential to contribute to noise reduction through secondary effects.

Demonstration effects – the degree to which the END has had positive catalytic effects by demonstrating the effectiveness and added value of investing in noise mitigation, abatement and reduction through NAP measure implementation in R1 and in R2. The fact that some countries have devoted significant expenditure through measures identified in NAPs to reducing noise may have positively influenced attention to noise mitigation in other countries at national, regional and local levels, for instance, in determining policy approaches, spending decisions and the degree of visibility given to noise mitigation at receptor.

Process effects – under Art.1 (1a, 1b and 1c), the END requires strategic noise mapping, making SNMs and population exposure publicly available, and the development of action plans

(with public consultation an integral part of the NAP finalisation process). The regular discipline of carrying out these activities every five years in liaison with national noise stakeholders and communities may have 'process effects' such as fostering a more rigorous and systematic approach to strategic noise management across the different sources than was the case pre-END, even in countries that already had environmental noise legislation.

The different types of effects are now examined in further detail and where appropriate, examples of these effects are provided:

Volume effects – the END was found to have had a catalytic effect in some EU MS by increasing the scale of funding invested in noise mitigation, abatement and reduction programmes and measures compared with equivalent national programmes prior to the END ('volume effects'). The END has also sometimes supported the putting in place of new programmes and measures at national, regional and local that were at least partly inspired by the existence of the END. In EU MS that did not previously have environmental noise legislation, a noise budget has been created for the first time. It is worth mentioning that this has happened at least in some EU MS against a backdrop of reduced public sector funding in most of EU-28.

As noted earlier, however, there are challenges in quantifying the extent to which programmes adopted after the END came into effect can be directly attributed to the END, partly because many programmes are of a long-term nature, and measures supported within them are part of a continuum which requires long-term policy planning and expenditure decisions, which means that the true extent of the END's impact is difficult to ascertain at this point in time.

In some EU MS (at least in the short term), there has been increased expenditure on noise mapping and reduced expenditure on noise mitigation and reduction, although given the long-term nature of expenditure commitments relating to the implementation of many noise measures, over time, the majority of expenditure in the great majority of MS is expected to be on noise mitigation, abatement and reduction measures (i.e. substantive compliance costs) rather than on noise mapping (which forms part of the administrative costs. Theoretically, if MS are spending more on environmental noise mitigation, there may be a corresponding reduction in budget in other areas (depending on priorities), although no evidence was found through the evaluation research that this is the case. Overall then, there is a mixed picture in respect of 'volume effects', with some MS attesting to an increase in resources for noise mitigation, whilst others stated that there has not been much of a change in the level of expenditure on noise mitigation at national / regional level since the END came into effect.

Examples were identified where the existence of the END has strengthened the visibility of environmental noise among policy makers and this had led to **additional funding being made available within transport infrastructure programmes through dedicated budget** (e.g. in the **UK** and **France**). It was noted that since the Directive was adopted, it has become easier for environmental noise policy officials to engage with their colleagues across different policy areas, for instance with planners responsible for long-term transport infrastructure planning, and officials responsible for urban development and planning.

Although it was made clear that whilst some expenditure programmes, such as transport infrastructure development programmes, would often have gone ahead anyway, the END has helped to ensure that environmental noise mitigation is taken into account more closely. For instance, in the **UK**, although noise mitigation was an issue that Highways England would have taken into account anyway, there appears to have been more explicit consideration for tackling noise at receptor than would have otherwise been the case, as demonstrated in the following case study on the Roads Investment Strategy 2015-2020.

Table 3.33 - Case Study - Roads Investment Strategy

Case study title:	The 'Road Investment Strategy' (RIS) , UK 2015-2016 to 2019-2020
Member State:	UK (England)
Measure description and Implementation bodies	Highways England is responsible for the Strategic Road Network (SRN) in England, which covers the busiest roads. Since most motorways and all‐purpose trunk roads were planned and developed between the 1930s and 1960s, many are no longer fit for purpose. In the decades that followed, traffic volumes have grown and today there are more than four million vehicles on the SRN per day. Investment has not kept pace with demand and network quality has declined. In response to these challenges, the 'Road Investment Strategy' (RIS) sets out a long-term programme for motorways and major roads with the funding needed to plan ahead effectively. The RIS is a multi-year investment plan to improve the network and create better roads for users. The first RIS will require investment of €21.28 billion (£15.2 billion) invested over the next 5 years in over 100 major schemes to enhance, renew and improve the network. The Highways Agency recognises that "there are problems such as noise and poor air quality, especially at hotspots located across the roads network". The RIS therefore incorporates a dedicated programme through an Environment Fund. Within this, funding is earmarked for noise mitigation and abatement. Examples of specific measures include retrofitting the SRN with low-noise surfacing, the creation of new bypasses and de-trunking of old roads, improving conditions for walkers and cyclists to encourage greater non-road usage, etc. Moreover, all new and improved roads across the SRN now use low noise road surfaces to reduce the noise made by vehicles.
Budget	Within the RIS, €420 million (£300 million) has been ring-fenced in an Environment Fund to deliver improved environmental performance across carbon, noise, water, biodiversity, landscape and cultural heritage. Within that budget, €105 million (£75 million) has been set aside for noise mitigation impacts over the next 5 years.
Type of effects	Volume effects (increased dedicated expenditure for noise mitigation) and scope effects (expenditure now targeted specifically at "Important Areas", which is a concept introduced in the UK that is driven by the END mechanism of using noise mapping to identify those areas where noise is greatest / and / or the number of affected people is significant.
Results / impacts	<u>Results</u> • Rolling out dedicated noise mitigation and abatement measures such as quiet road surfaces across 100 road schemes. • The RIS should benefit up to 250,000 people by reducing the noise impact of England's motorways and major roads. <u>Impacts</u> • An ambitious target is set out in the RIS that by 2020, the UK road network should be a better neighbour to communities, with over 90% fewer people impacted by noise from the SRN.
Attribution effect/ impact of the END:	The investment strategy covers updating large parts of the UK network for logistical and economic reasons and would have existed without the END. However, it was recognised that the environmental impacts – including noise - needed to be taken into close account in implementing the strategy. The END was regarded as having been useful in influencing decisions about how and where noise mitigation funding should be spent. For instance, Highways England is currently focusing on END-defined Important Areas which were prioritised through strategic noise

Case study title:	The 'Road Investment Strategy' (RIS) , UK 2015-2016 to 2019-2020
	mapping for mitigation measures. The national authority in England commented that the END had encouraged Highways England to give greater consideration to incorporating noise mitigation and abatement in the Road Investment Strategy than would otherwise have been the case.
Monitoring / evaluation	Too early to monitor the RIS's implementation, since it only started in 2015.
Further information	https://www.gov.uk/government/collections/road-investment-strategy

Source – UK research team and CSES analysis of information on the treatment of noise in the RIS, interview with Defra and email contact with Highways Agency.

In **France,** the national CA also mentioned that additional funding had been made available for noise mitigation and abatement through national funding programmes since the END was adopted. According to an interviewee, several hundred million EUR has been devoted to noise mitigation, mainly through annual expenditure of some 100m EUR on upgrading parts of the national road network with quieter road surfaces.

With regard to **scope effects**, some evidence was found of instances where the END has promoted a more visible focus on noise mitigation, abatement and reduction than was the case previously both in overall policy terms at the national level, and in respect of some national spending programmes (e.g. urban infrastructure development, road infrastructure planning). Noise at receptor has moreover been considered more prominently than was the case pre-END in several countries.

For instance, in **Ireland**, consideration of noise mitigation in road infrastructure development has been mainstreamed from the outset). In the **Netherlands,** public authorities at the city level in particular within agglomerations attested that there had been a significant increase in funding for noise mitigation, suggesting strong scope effects compared with the baseline even though there was already well-established national legislation. Conversely, this was not the case in other EU countries. For example, many stakeholders in **Germany** responding to the online survey did not think that the END had made any difference, since long-term mitigation programmes have been continued anyway and many measures have not gone ahead at all due to a lack of budget and the fact that local authorities responsible for preparing NAPs may identify measures which are more of a wish-list than a reality because spending bodies have not authorised the expenditure that would be required within their strategic planning and budgeting.

The onset of the economic and global financial crisis was found to have severely limited the scope to increase funding for environmental noise mitigation in some countries, such as **Italy, Spain** and **Portugal**. This was also the case in some of the newer MS such as **Latvia** and **Lithuania**. The research showed that several EU countries had intended to increase funding for noise mitigation measures when NAPs were prepared, but were unable to do so in practice, and had had to scale back their initial ambitions due to budgetary crises at national and regional level, which in turn had led to a lack of funding for noise mitigation (and in some cases, also for mapping).

The picture in respect of scope effects is likewise somewhat nuanced. Although several countries were identified where the END appears to have had a positive effect in strengthening the scope of noise mitigation measures by encouraging consideration of noise at receptor in policy and spending planning in other areas, there were equally other countries where the scope of noise reduction measures has not increased, in many instances due to lack of budget and/ or coordination with relevant spending bodies.

The END was also found to have had some positive **demonstration effects**, where measures have gone ahead and been implemented, and this may have had a catalytic effect in encouraging other MS to identify budget for and to implement similar types of measures. However, less positively, the research found that only a small percentage of R1 NAPs have fully implemented measures requiring expenditure (e.g. noise barriers, quiet road surfaces). This was partly due to the economic and financial crisis with more limited budgets (which has continued into R2 implementation). However, equally, stakeholders pointed to the long-term nature of the noise mitigation cycle and associated planning. This means that there is scope for the magnitude of such effects to increase in the latter stages of R2 implementation and in subsequent rounds of NAP implementation. The scope to use the case studies undertaken as part of this study (see Appendix E) to strengthen the evidence base as to the nature and magnitude of effects of different types of measures should also be emphasised.

The interviews suggest that the END has had a positive demonstration effect by encouraging at least some MS to engage in comparative benchmarking, for instance, to compare action planning approaches and also the types of environmental noise mitigation, abatement and reduction measures identified in NAPs in other MS.

Moreover, at the validation workshop to discuss the evaluation results, it can be noted that there was strong interest among participants in obtaining the country reports so as to be able to compare different national practices with regard to setting national limit values at receptor, whether these are binding and how these are enforced. This suggests that there is continued scope to strengthen the role of information exchange between MS through the data and information produced through the END in future. The Commission's important reporting role on END implementation is also important to mention here, since it has a role in serving as a conduit to disseminate information and knowledge about which types of mitigation measures, policies, practices and approaches are effective.

Since under subsidiarity, the END does not adopt a prescriptive approach there are advantages in promoting opportunities for exchanges of experiences and practices between END stakeholders so as to facilitate benchmarking between countries and to strengthen areas of weakness in END implementation, such as enforcement at national level, and good practice in the designation and crucially in the implementation of quiet areas. In other policy areas, this type of approach has been termed an "Open Method of Coordination".

A practical example of how national CAs are already learning from one another is that a combination of EU and national good practice guidance on different aspects of END implementation (e.g. on quiet areas, noise mapping and action planning) has sometimes been used by MS that do not yet have any national guidance of their own as the starting point for the development of such guidance.

In conclusion, it will take time for the 'demonstration effects' of measures implemented through the END to fully materialise, but the cost-benefit benchmarks and estimates of the corresponding health effects will provide useful data that the MS can use for their own benchmarking purposes to help determine how resources should best be spent to address the areas for priority action identified through noise mapping. For instance, cost- benefit benchmarks could be utilised in future to better prioritise spending so as to maximise reductions in the noise-exposed population.

Lastly, the research identified evidence of **'process effects'**, whereby the END was acknowledged as having promoted a more systematic approach to strategic noise management than was the case pre-END, even in countries that already had environmental noise legislation. For instance, before the END in some countries, noise mitigation strategies had been prepared on an ad hoc basis for particular sources or in larger cities. Likewise, SNMs had also been prepared, but these were neither available for all transport sources nor made available to the public systematically. By ensuring

that CAs responsible for strategic noise mapping and action planning across the EU are part of the same five year strategic planning processes, the END has added value. This was confirmed for example by some airport operators, who stated that they had built five year strategic planning as part of the END into their management decision-making processes, and this was not something that they would change, even if the END were to be repealed.

There were however questions raised by many END stakeholders as to whether the process could be made more effective by extending the 12 months' timeframe between SNM and NAP submission, but this is addressed under effectiveness rather than added value.

3.2.6.3 Action at EU level – survey findings

EQ15 - Do the issues addressed by the Directive continue to require action at EU level?

The feedback on the online survey indicates that there is strong support for continued action at EU level**.** In response to the question *when approximately do you expect the objectives of the Directive to be fully achieved at EU level?* The majority of public authorities could either not make an estimation or estimate END objectives will not be achieved before 2020. This was particularly the case for the objective relating to laying the basis for future legislation, where 91% of public authorities could either not estimate a completion year or believed it would be 2020 or later. Sixty per cent of public authorities also believe it will be 2020 or after until the objective relating to the development of a "common approach" will be achieved.

Table 3.34 – Estimated timeframe for the full achievement of END objectives (%) (N=57)

	2015	2016	2017	2018	2019	2020	After 2020	Don't know
a) Relating to the development of a common approach (Art 1(1))	0	0	19	5	5	11	35	25
b) Relating to laying the basis for future legislation (Art 1(2))	0	0	5	0	2	7	32	54

Source: Online survey of public authorities

The table above indicates that greater progress has been made in respect of the achievement of the first objective of the END than the second. This is perhaps not surprising since a common approach to noise assessment methods, with comparable data, is a prerequisite before policy makers interviewed appear likely to use END data fully to inform source legislation.

In terms of feedback on anticipated timescales, the majority of public authorities estimated that the END's objectives will not be achieved before 2020. Sixty per cent of public authorities believe a common approach to noise assessment methods and to assessing the harmful effects of noise will be realised either in 2020 or later.

Many stakeholders interviewed stated that the full added value will only materialise in subsequent reporting rounds, due to the need for sufficient time to implement harmonised noise assessment methods through Commission Directive (EU) 2015/996. The second objective of the END of laying the basis for future source legislation has not been realised within the timeframe of this REFIT assessment. 91% of public authorities could either not estimate a completion year or believed it would not be before 2020 or later. This reflects the longer timeframe involved in achieving comparable and comprehensive data through a common approach before the data is fully able to inform EU source legislation.

3.2.6.4 Further enhancement of the European added value

A further question analysed was:

EQ16: Are there any ways in which the European added value of the END could be further enhanced?

A number of suggestions were made as to how the END might be enhanced. In this section, examples of stakeholder feedback are provided, but since the future of the END relates to 'prospective issues' suggestions on possible ways forward to enhance the effectiveness and value added of the END are set out in Section 4.2 (Future Perspectives). The main feedback was that:

- Maximising the END's value added is dependent on the revised Annex II, Commission Directive (EU) 2015/996 being implemented, since using the CNOSSOS-EU common assessment methodology is crucial to achieving more comparable data, which in turn is essential to maximise the utility of END population exposure data for EU policy makers responsible for (transport) source legislation;
- Delays in the submission of R2 SNMs and exposure data to the EC need to be overcome, since data gaps in some EU countries will undermine the establishment of a clear baseline against which progress in reducing noise pollution can be assessed. In particular, the lack of complete data, as well as the lack of comparable data may limit the contribution to reviewing current LVs for existing source legislation.
- It was suggested that MS could be required to implement noise mitigation measures rather than only to produce NAPs and identify measures. The legal text currently stops short of compelling countries to implement measures. Various stakeholders are of the view that the added value of the Directive could be strengthened, for example, by putting a stronger emphasis on noise mitigation.
- There were mixed views as to whether introducing EU receptor-based noise limit values would be appropriate. Amongst some stakeholders, environmental noise at receptor was viewed as a domestic issue best tackled at local level, making it difficult or impossible to implement a harmonised approach. However, opinions were divided on this issue among stakeholders and some stakeholders support the introduction of common, source-specific EU-level limit values.
- There was strong support for setting broad, non-mandatory targets for noise reduction either at an EU level or specific to individual MS depending on their relative baseline situation. Several EU industry associations (and some national CAs interviewed) pointed out that added value could be strengthened by providing EU funding to support for MS to co-finance noise mitigation and abatement measures. However, it is unclear which EU funding source could be used.
- According to a number of stakeholders, added value could be strengthened by providing guidance and more detailed specifications for quiet areas in future. However, there was limited support for this suggestion among workshop participants, since most MS appreciated the flexibility of not having a too prescriptive approach to quiet areas, although they would like EU practical guidance on how to implement the concept.

EQ17 - What would happen if the END were to be repealed?

This question builds on a 'counterfactual' scenario in which the END were to be repealed. The main source of information is the validation workshop, and the evaluator's assessment based on carrying out detailed discussions with more than 100 END stakeholders, since an EQ was not originally included within the evaluation's scope.

Notwithstanding the limitations linked to attribution in countries that already had environmental noise legislation, it can reasonably be assumed that if the END were to be repealed, then **MS would largely revert to using their own national methods of noise mapping and action planning**, perhaps with the exception of Scandinavian countries who would continue to use the Nordic 2000 model across several countries.

Another point is that if the END were repealed, there would be **no common, harmonised approach to producing population exposure data**. This would make it more difficult for EU policy makers responsible for source legislation to assess the net effect of existing source legislation by providing data across the EU on noise at receptor (notwithstanding the comparability issues which mean they are not yet using the data). This in turn would also make it more difficult to assess the negative health effects of environmental noise at EU level, or to assess the positive health impacts arising from reductions in noise levels through measure implementation.

Countries facing severe budgetary constraints may decide to drop noise mapping and action planning altogether, or to update noise maps and action plans less frequently (e.g. once every 10 years). In the absence of an EU legal framework, MS would have fewer incentives to implement measures identified in NAPs, since they would not be benchmarked against other MS. Of course, some countries may continue to produce noise maps, but it is unlikely that this would be the case across EU-28 as a whole.

In general, it can be surmised that **environmental noise would become less of a priority among national policy makers vis-à-vis other environmental concerns** such as air and water quality, or climate change. The resulting adverse effects on public health for the population affected by noise pollution can be inferred from the Noise in Europe Report, 2014.

The assumptions produced as part of the CBA produced for this evaluation suggest a positive benefit-cost relationship in respect of measures implemented through NAPs. If the END did not exist, it can be assumed that some noise mitigation measures would still go ahead anyway because measures identified in NAPs were driven by national regulations or there were other primary regulatory drivers, such as introducing speed limits to help reduce pollution and comply with air quality limits. However, **at least some measures would not have been identified and / or already have been implemented had it not been for the existence of the END.** There would therefore have been a higher number of exposed persons to environmental noise (see EQ9b - Has the Directive contributed to ensuring that by 2020 noise pollution has significantly decreased?).

Since the END puts a strong emphasis on a **more strategic approach to noise management**, in the absence of the END, there is a clear risk of returning to an approach to **noise management that was less anchored in a strategic planning approach,** and where if there were no EU legislation in place, it would be more difficult for national policy makers responsible for environmental noise policies to secure the buy-in of their colleagues in other relevant policy areas.

The interviews suggested that even if there was national legislation in place beforehand, it was more difficult for civil servants working on environmental noise issues to secure dedicated funding for noise mitigation before the END. The fact that there is a Directive, has, as noted earlier, put noise on the domestic agenda in a way that would diminish if the END were repealed.

The cost-benefit assessment (CBA) in Section 3.2.4 under efficiency showed that many of the positive health effects and long-term benefits are likely to take time to fully materialise. Since the sustentative costs incurred by MS in respect of END measure implementation are mainly incurred upfront, yet the benefits are likely to occur over a much longer time horizon (up to 25 years), it does not seem advisable to repeal the Directive, when the main benefits of measures have not yet been realised. Of course, some benefits will still accrue once the money has been spent on measure implementation, but not all benefits would arise and there is a strong risk that some measures planned under the END would not be prioritised if the Directive was repealed.

Overall, since there are benefits of the END in fostering a common approach at European level that would not otherwise occur in the absence of an EU-wide common approach to data collection, and considerable further benefits as a result of additional noise mitigation measures that may not have occurred in the absence of the END, repealing the Directive would not be appropriate, on the basis of the evidence presented in this report.

Key findings - European Added Value (EAV)

In summary, a number of findings can be made in respect of EAV.

Overall

- The END demonstrates strong EAV because it has put in place a common EU legal framework for the first time. Moreover, at a national level, approximately 15 MS did not have environmental noise legislation prior to the END's adoption;
- The Directive has made a significant positive contribution to putting the issue on the domestic and EU-level political agenda, and in raising awareness among policy makers and the wider public;
- A minority of stakeholders maintain that added value has been limited given that there was already existing national legislation on environmental noise and mitigation, abatement and reduction initiatives in place prior to the END;
- The distinction between national measures and those that can be considered as having been implemented through the END (albeit using national funding, given that the END lacks its own budget) is arbitrary, since many noise mitigation and abatement programmes are of a long-term nature.

Absence of the END

- Without the END, there may have been noise maps available in some countries that were useful for national, regional and local policy and decision-making purposes, but there would not have been noise maps produced using common metrics across the EU to inform source legislation.
- In instances when noise mapping was carried out prior to the END, this was often in the context of land-use planning, for instance, proposed housing developments in proximity to major transport infrastructure and airport expansions or due to national regulations
- Post-END, noise mapping for national purposes, such as land-use planning sometimes still relies on national methods and descriptors where these relate to national legislation or adherence with specific guidance documents e.g. WHO, National Standards etc.
- However, a clear added value of the END is that mapping was not required in most MS prior to the END. This meant that there was a lack of population exposure data collected systematically by source in most MS, and certainly across the EU as a whole. Since such data is necessary to assess the health effects of high levels of

noise at both national and EU level, the data collection process provides vital data collected on a common basis and which was not previously available.

- In countries where there was previously no environmental noise legislation, it is unlikely that there would have been as much focus on noise mitigation, abatement and reduction measures, since there would not have been any legislation to encourage public authorities to identify and implement measures.

- Although there may have been some measures where there are noise mitigation benefits but other primary drivers (e.g. road safety, planned transport infrastructure development), it is unlikely that there would be dedicated noise mitigation, abatement and reduction measures in at least some countries that no such legislation prior to the END.

- In those MS that already had such legislation, had the END not existed, there would have been fewer differences, in that MS with a long-established regulatory framework have typically allocated funding to noise reduction and mitigation both pre-END and post-END. Nevertheless, the fact of having a European Directive in place was found to have led to the heightened the visibility of environmental noise. Given this, in the absence of the END, there would have quite possibly been lower expenditure available for environmental noise mitigation.

3.3 Questions on Future Perspectives

Although most aspects of the evaluation are retrospective, a number of forward-looking questions were posed in the Tender Specifications for this study. The detailed responses to these questions are now set out. It should be noted that in addition, in assessing the previous 17 EQs and sub-EQs, the analysis has suggested a number of possible ways forward to strengthen the relevance, coherence, efficiency, effectiveness (and impacts) and the European Added Value of the END. Suggestions in this regard are set out in Section 4.3 (Future Perspectives).

EQ18 - Is the scope of the Directive (as laid down in Art. 2) appropriate or does it need to be modified?

This is mainly a coherence question. However, there is a future-oriented issue as to whether the END's current scope as set out in Art. 2 is sufficient and appropriate.

The scope of the END was found to be broadly appropriate. However, some stakeholders questions why schools and hospitals are mentioned when they are not addressed elsewhere in the END. The broader issue of the END's scope also relates to Art. 3 and was already addressed in the analysis of relevance (see Section 3.2.1). It is made clear that many END stakeholders do not think that the scope is sufficiently ambitious since it focuses on the process of achieving a common approach and not yet on setting out a clearer long-term objective, such as a target for the "percentage reduction in the number of people exposed to potentially harmful effects of noise above a specific dB threshold". A further issue is that in defining quiet areas in open country in Art 3(l), recreational activities are referred to, but these are not mentioned anywhere else in the Directive

EQ19 - Are there gaps where further EU noise legislation is required in order to achieve the objectives of the Directive?

The research did not identify any areas not already covered where new EU legislation on noise at source could be required in order to achieve the END's objectives. This was confirmed through a detailed legal mapping assessment of existing EU source legislation across the different relevant transport sources (see Section 3.2.3.6 and EQ8 - What progress has been made towards achieving the END's second objective?).

Rather, as detailed in the section dealing with external coherence, the main role of the END is to inform *existing* source legislation through the collation of the results reported by EU MS through strategic noise mapping and through the provision of population exposure data.

EQ20 - How could the reporting mechanism be improved?

In EQ12, the efficiency of the END reporting mechanism ("ENDRM") was examined. In EQ20, ways in which the ENDRM might be further strengthened and its efficiency improved in future are considered, along with possible means of simplifying reporting requirements and enhancing use of open data already made publicly available.

It should be noted that these suggestions draw on the interview research, the open responses to the online survey and on the responses to the OPC on the evaluation. In addition, they rely on the evaluation team expert's judgement having conducted a desk research-based review of END reporting data and information currently available, the two databases on SNMs and NAPs and of the EEA Handbook since this sets out the structure of the ENDRM and Data Flows.

Firstly, MS are **currently able to submit reporting information through any delivery mechanism they wish**. Whilst the majority of MS are using Reportnet, this is not the case in all MS. Some national CAs appear to prefer to send NAPs directly to the EC in hard copy. At least in one MS, the formal submission of reporting information was made by the permanent representation in Brussels rather than by the CA directly, accompanied by a covering letter. In the evaluation team's view, it would be more efficient to restrict the ENDRM to a single mechanism, the Reportnet. The rationale is that there are advantages in having a common shared information infrastructure since the data and information reported by the MS is automatically updated in the linked CDR, which would mean that reporting data could be aggregated in real-time.

The EEA Handbook for the delivery of data in accordance with Directive 2002/49/EC makes clear that *"To maximise inter-comparability and harmonisation between MS, a fixed common format for reporting is necessary".* Any data not submitted via the Reportnet electronically would therefore have to be re-entered manually which would slow down the reporting process and be less efficient than having MS input the information and data with this then being collated automatically in the CDR.

Moreover, given the difficulties that have been encountered in the lack of timely submission of reporting data and information by some MS in both R1 and R2, **gaps could be identified more easily if Reportnet were to be used as the single END Reporting Mechanism.** Since all MS have access through the EIONET to the Reportnet, this should not cause CAs any particular problems, other than ensuring that they make sufficient human resources available to upload and submit the data and information.

It is appropriate that MS should submit electronic versions to the EC, and **avoid sending hard copies unless the electronic version has already been sent** (and the hard copy is a courtesy duplicate copy for the EC). Submitting in hard copy only is not in the views of the evaluators appropriate, since the data and information would then need to be reinputted manually by the EC (or the EEA or their contractors on behalf of the EC) into the CDR so that the data can be aggregated at an EU-28 level.

Moreover, since SNMs and population exposure data has to be made publicly accessible not only at the MS level, but also at the EU level through the EEA's Noiseviewer tool, streamlining the reporting process so that all MS submit electronically through Reportnet would help to strengthen efficiency by further automating the process.

Secondly, suggestions were made as to how to simplify the process of transmitting reporting data and information to the EC through Reportnet. In the **UK**, for instance, it was suggested by the national CA in their submission to the OPC for the UK that the ability to upload **pre-completed Word documents (or similar) instead would be much simpler than completing online forms** and would still meet the legal obligation (c.f. Data Flow 6_9[165] and Data Flow 7_10[166]). It was however noted that some information submitted via spreadsheets uploaded by national CAs is already used directly by the EC for reporting population exposure assessment (Data Flow 4_8[167]). This was viewed as being welcome since the data could be directly used by the EC without having to be re-entered by the national CA. It was posited that this approach could be extended to other forms of reporting. However, whereas data in Excel can be used directly by the EC for END reporting purposes, if MS were to submit information in Word instead of via the data fields in the ENDRM, this would still require data entry by the EC (assisted by the EEA). There are two alternative options:

- Simplify and / or reduce the number of data fields that MS have to input into the reporting system.
- Allow MS to submit some reporting information in standard Word templates using a common format and ensure that the EEA is allocated resources to transfer this reporting information into the Reportnet's CDR directly.

In the view of the evaluators, either of the above approaches could help to reduce administrative reporting burdens but the latter is predicated on the EC making the necessary resources available to coordinate the transfer of information and data from Word to its own databases. Arguably, one advantage of the latter approach is that if the EEA were delegated responsibility by the EC for transmitting any reporting data submitted in Word templates into the database, this could be built into a data quality and consistency check of the reporting information provided.

A further suggestion made by a national CA in the **UK** related to the possibility that **the EC (supported by the EEA) could make greater use of open data that is already publicly available** since some MS have a strong open access data policy and publish all the END information that has to be reported online in the public domain. However, whilst this is a useful suggestion, there may be practical difficulties. Many MS do not publish all reporting information on SNMs and NAPs via a single portal, especially in the case of MS that have adopted a decentralised implementation approach. For example, **France** does not appear to have a single portal but rather individual CAs publish NAPs and SNMs online. Also, if the EC was reliant on gathering data via online portals, all MS would need to ensure that the data were readily available via a single online portal and this would also require the EC (or EEA on its behalf) to be allocated sufficient resources to collect and enter END data and information manually.

The question of open data more generally also relates to information accessibility (EQ7b). Overall, gathering data directly from open source databases and websites is a viable option in future, but only if all EU MS get their act together in terms of making all the data and information available on a timely basis ideally accessible via a single portal that the national CA coordinates and updates regularly. Unless this is the case, it will not be possible to avoid the need for MS to input the same data via the Reportnet.

Thirdly, there were found to be **some weaknesses in END reporting data and information** in respect of **SNMs and exposure data within agglomerations**. In particular, in the current database, data is collected in respect of transport sources *within* agglomerations, but not in respect of agglomerations *overall*.

[165] DF6_9: Noise control programmes for major roads, railways, airports and agglomerations
[166] DF7_10: Noise action plans for major roads, railways, airports and agglomerations
[167] DF4_8: Strategic noise maps for major roads, major railways, major airports and agglomerations

Moreover, completeness information for major roads and major railways is only collected at country (and sometimes at segment) level, but not by km of major roads and railways within scope of the END. In future, an interviewee involved in analysing the data submitted by MSs suggested, it could be "necessary to evaluate the completeness of major road and major railway network at the segment level, which would provide a completeness value closer to the current reality".

This would however necessitate changes to the reporting requirements of the END, but the ENDRM itself would not need to be changed. This is dependent on clarifying and interpreting in relation to the expectations of the EC and the MS concerning how important it is to have a 'real-time' picture of compliance. If MS submitted all reporting information and data on time then spending resources to assess data completeness would be a much less important priority. An even more refined picture would be available if MS submitted coverage data for major roads and major railways by km covered within END scope.

Another way to improve the kind of data and information reported on SNMs would be to clarify that information on major roads and major railways completeness should only look either at road and railway segments *inside* or *outside* of major agglomerations, or *both*. **Currently, this has not been systematically clarified across all MS, thus impairing data comparability.** The ENDRM handbook could be updated to this end.

Fourthly, one of the aspects of the ENDRM that could potentially be improved is that the Reporting Mechanism should be tweaked so that it provides an **early warning system for the EC to flag up a situation where MS have missed the formal cut-off dates for the submission of reporting data and information stipulated in the Directive**. Likewise, if within specified periods of the formal reporting period, data completeness remains lower than anticipated, this could **trigger an alert sent to both the EC and the MS concerned, so that there is a formal mechanism for ensuring that both parties are aware when data has not been submitted**. Contact could then be made with the MS concerned to establish (i) what are the reasons why the data has not yet been submitted (ii) which remedial actions the MS proposes to take to address the problem and (iii) by when the MS intends to provide the END reporting data and information.

A **written explanation for the delays from the national CA could be required in a future possible revised Directive by the EC within a specified timeframe.** There is of course a need here to refer to the findings in respect of effectiveness (EQ7a) relating to progress in respect of Article 1(1a) strategic noise mapping, and the second implementation review (Section 2.3.7), which identified delays in some MS in both Rounds in the submission of reporting data and information to the EC.

However, before making any such changes to the Reportnet reporting system that could require MS to report more promptly on any challenges that they have encountered in meeting the deadline, it is important to acknowledge the challenges identified earlier in the report relating to the timeline for the submission of NAPs. In Section 2.3.7 and 2.3.8, it was noted that most MS found that the 12 month period between the formal submission of SNMs and NAPs is too short to allow sufficient time for action planning and consultation processes. Indeed, action planning methodologies themselves were found to be incompatible with a 12 month timeframe (e.g. in Germany among local municipalities). This suggests that the timeliness of reporting could be improved by making the timeframe for reporting submissions more realistic in the first place, perhaps by extending the submission period to 18 or even 24 months instead of the current 12 months.

Fifthly, in EQ12, a description of the way in which the Reporting Mechanism operates, including Data Flows and how the relational databases in the CDR are linked to Reportnet has been provided. Generally, the ENDRM was found to work efficiently. However, **it was identified that presently no monitoring data is collected in relation to the implementation of measures foreseen in NAPs**. Such data would be useful in order to be able to better ascertain whether MS have implemented particular measures identified in NAPs in full or partially, and the actual costs as opposed to the projected, which may differ significantly.

This could provide **important data and information for future cost-benefit assessment work**, which is presently dependent on ex-ante projections before measures are implemented set out in NAPs at the outset of each Round and case study work, which requires external consultants. Although in theory, such information should already be included within NAPs (i.e. as part of Annex V setting out the minimum requirements for NAPs), in practice, this was rarely found to be the case.

An alternative approach would simply be to **collect data on measure implementation directly from CAs through Reportnet.** Since the number of measures per NAP that actually go ahead is relatively low, this would not be that burdensome per NAP, although it could cause greater administrative burdens for those MS that have adopted a highly centralised approach and have to produce many NAPs overall. If such monitoring data were to be collected, it would provide a more comprehensive picture as to which measures have been supported, and the magnitude of impacts (i.e. the extent of the END's contribution to reducing noise which although not an explicit objective, is implied in the recitals).

Sixthly, the interview feedback also revealed **differences in the level of understanding about particular aspects of the reporting system**, such as whether national CAs should send complete NAPs or only summaries. Whilst the Directive clearly states only a summary as a requirement, there is uncertainty as to what constitutes the formal submission of a NAP. Some interviewees also noted that the current approach raises the problem that some MS may submit a summary of a NAP but then have not actually finalised, adopted in their MS or published the NAP online. This has the potential to create material uncertainty with regard to data completeness figures. One possibility could be to **organise a training session for relevant MS authorities by the EC** (supported by the EEA) so that national CAs have a better understanding as to how the reporting system works, the precise deliverables/ outputs that should be submitted etc. This could be repeated periodically (e.g. once every three years) to allow for the fact that there may be staff turnover changes within national MS CAs.

A further point was that there is a question mark as to **whether it is really necessary to involve the Permanent Representations in Brussels** to inform the EC by letter that NAPs and SNMs have been submitted. If all MS were to utilise the Reportnet instead, and use electronic submission of data, then the EC could be automatically informed through an email alert to inform the EC that particular SNMs, NAPs or a complete dataset of SNMs and NAPs has been uploaded by a particular MS (since country codes are used to upload the information). Otherwise, there is a risk of compartmentalisation of information regarding the timing of submissions, which emerged from the research in relation to the extent of coordination between the EC, the EEA and their contractors. Email reminders could also be used ahead of reporting deadlines to remind the particular MS concerned of an imminent reporting submission deliverable.

A penultimate point based on the data collection and analysis carried out for the implementation review is that the **extraction of data and information from the database for users at EU level** could be improved. Although the CDR provides a useful mechanism for aggregating the data, it was found to be difficult to easily extract information on at an EU-aggregate level for NAPs in particular.

Lastly, as the quantity of data in the database increases in size over successive END implementation rounds, this raises the question as to whether the EC should consider using **more sophisticated software in order to analyse the data, such as STATA (http://www.stata.com/) or SPSS**.

Previous experience in managing large datasets suggests that Excel is efficient as a mechanism for collating and storing data. However, for the data analysis stage, there could be advantages in using software with more sophisticated analytical capabilities. For instance, there is the possibility of analysing any duplicate entries in a more sophisticated way than would be possible using Excel, which only has limited duplicate analytical tools.

4. KEY EVALUATION FINDINGS, CONCLUSIONS AND FUTURE PERSPECTIVES

4.1 Key Evaluation Findings

The Terms of Reference for this evaluation included a list of evaluation questions to be addressed. Detailed answers to these questions have been provided through the analysis contained in Section 3. Additionally, several more technical questions ("EQs") relating to the achievement of common assessment methods taking into account scientific and technical progress are provided in Appendix G. In Section 4, a summary of the conclusions to each of the EQs[168] is provided.

These answers draw on the evidence and analysis presented throughout the report, particularly the summary of evaluation findings in respect of to each EQ.

Relevance

EQ1 - Are the objectives of the Directive still relevant?

The evidence suggests that the objective of Art. 1(1) of a "common approach to the assessment of environmental noise using common indicators" remains highly relevant to identified needs. However, a 'common approach' is an intermediate objective and the END does not presently set out a clear longer-term public health-based objective against which to evaluate its "relevance". Whilst improving health is implicit in the END, it could benefit from being made more explicit (e.g. "reducing the percentage of EU citizens exposed to environmental noise above dB threshold by a target of X %").

The second objective of the END (Art. 1(2)) of 'providing a basis for developing EU measures to reduce noise emitted by major sources' also remains highly relevant to identified needs. There is evidence to suggest that in order to address the problem of environmental noise and its health effects effectively, action needs to be taken at both source and receptor in parallel. Moreover, the absence of population exposure data based on noise mapping results prior to the END meant that policy makers responsible for source legislation had no clear source-specific baseline data on which to monitor the scale of the problem at receptor (and to assess the net contribution of source legislation). The collection of population exposure data on an EU-wide basis also remains strongly relevant given the importance of strengthening the accuracy of the assessment of the adverse health effects of noise at receptor, without which it would be more difficult to (i) strengthen source legislation and (ii) persuade national policy makers and funding bodies to invest in measures to mitigate and reduce noise at source.

EQ2 – How far is the END coherent and consistent with other EU legislation on noise (e.g. noise at source legislation (including by transport type i.e. automotive, railways, aviation)?

The research has shown that the END is acknowledged as being consistent with, and complementary to, other EU source legislation by the majority of stakeholders. Only a minority stated that there were inconsistencies between the END and other legislation. The evidence gathered through the research found that the relationship between the END and noise at source legislation is consistent, with wide acceptance of the mutually supporting nature between legislation at source and receptor. However, not all END stakeholders were aware of the inter-relationship between the END and EU source legislation.

[168] It should be noted that the order of the evaluation questions has been restructured during the assignment to address the main issues in a logical structure under each evaluation criterion.

Ensuring consistency is however an ongoing process related to the updating of existing EU legislation. For instance, several key Directives in the automotive and aviation sectors and Technical Standards for Interoperability (TSIs) in the railways sectors have been revised in the past three years, and the process of strengthening consistency and coherence between different pieces of legislation is therefore already relatively well advanced, with explicit references to the END and the potential utility of population exposure data in the recitals of updated source legislation. There were however some issues relating to the need to strengthen consistency between the END and source legislation in the case of those Directives that date prior to the END's adoption. The review of existing EU noise at source directives and regulations found that these are typically only revised once every 10 – 15 years. It will consequently take considerable time before all noise at source legislation is fully strategically aligned with the END.

Coherence

EQ3 - Are there any specific legal gaps, overlaps and inconsistencies identified between the END and other EU legislation?

The research found strong coherence between the END and other EU environmental legislation, with no evidence of duplication and minimal overlap.

The only area where there was some concern about overlap related to the mapping of industrial noise within agglomerations, since this falls within the scope of the END but industrial noise control also falls within the scope of the Industrial Emissions Directive (formerly the IPPC). However, this was mentioned by a minority of stakeholders and the majority of stakeholders did not see this as duplicative. The issues identified appear to relate to practical implementation issues, such as ensuring clarity as to which industrial sites should be mapped under the IPPC and which under the END, rather than to actual duplication *per se.*

There was however evidence of a need to undertake a legal review exercise in future to update the END so as to reflect the broader EU legislative developments that have taken place since the Directive was adopted. For instance, the INSPIRE Directive was adopted after the END but has implications for some aspects of END implementation, such as encouraging EU MS to go beyond simply making information accessible to a more active open data policy (this could also potentially bring about efficiency savings in future).

However, since the END is implemented under subsidiarity, responsibility lies not only with the EC (ensuring that the complete dataset is made available so that it can be integrated into spatial datasets) but also with the MS. Since environmental noise (at receptor) was widely acknowledged as an issue best addressed at local level, it is individual MS' responsibility to ensure that END population exposure data is made readily available to EU citizens and other relevant stakeholders and where appropriate, linked to other spatial datasets as part of the INSPIRE process.

A further issue identified in relation to the need for updating the END was that since the Directive was adopted, the Lisbon Treaty came into effect (1 December 2009). Some wording changes will be necessary when the legal text of the Directive is updated in future. However, the changes required are expected to be relatively minor, such as ensuring that references are referring to the EU rather than to the Community.

A gap in the Directive as it currently stands is that Art. 1(1) is concerned with *defining* a common approach. Clearly, in order for the Directive to be effective, there is a need to go beyond defining to actually implementing a common approach (at least in respect of the collection of comparable data based on common assessment methods). The objective of "*defining* a common approach' is more appropriate for the early stages of END implementation (the first five to ten years), rather than to the objective over the longer-term (ten to twenty years) of having a fully common approach with comparable data able to influence source legislation and ensuring that a comparable and robust dataset is available between rounds on the basis of which MS can take action on a prioritised basis.

EQ4 - How does the Directive relate to national noise policies and legislation? Is it consistent and to what extent does it duplicate existing requirements?

National noise policies and legislation were found to be consistent with the END, at least now that national legislation has been amended as part of the END transposition process in those EU countries that had pre-existing legislation on environmental noise. . . In such countries, there was a need to ensure appropriate alignment between the END and pre-existing national legislation.

From a MS perspective, beyond the immediate transposition phase, ensuring coherence has sometimes led to practical complications in END implementation by national CAs. Although most issues have now been resolved, there are ongoing challenges for some MS, such as the need to produce data and to report to the EC based on a common assessment method and the L_{den} and L_{night} metrics, whilst at the same time continuing to produce data using national computation methods and noise indicators for national reporting purposes. However, this problem was specific to a few countries, such as in Scandinavia (Nord 2000) and in the UK (where noise maps based on LEQs are still required for national reporting purposes for major airports). This problem was however confined to a few countries. Most countries already report only in L_{den} and L_{night} for both national and END reporting purposes or are planning to do so as part of the transition to implementing the CNOSSOS-EU methodology through Commission Directive (EU) 2015/996.

EQ5 - Are there any elements of the Directive (e.g. specific articles/ sub-articles, definitions of key terms, requirements for public authorities) that are unclear? Are there any provisions that are obsolete and if yes, why?

Although a review of the legal text of the Directive found it to be broadly consistent, specific examples were identified where particular aspects of the END were either seen to be inconsistent, or where the terms and definitions used were regarded as requiring further clarity. These are however based on the perceptions of END stakeholders overall, which includes the views of local authorities that may be less familiar with the intended meaning of EU legal texts. The perceived problems were found to be concentrated in a few areas, such as within Art. 3 (definitions). For example, the definition of an agglomeration, a quiet area in open country and a quiet area in an agglomeration were found to have led to the most common interpretation and definitional problems.

A number of END stakeholders stated that greater clarity would be helpful in interpreting the requirements in the END. Among the examples where further EU guidance would be appreciated is in determining how MS should (1) prioritise the management of harmful effects (2) select quiet areas in both urban areas and in open country (3) shed light on what is meant by the term to undertake noise mapping once every 5 years if necessary. This could be achieved through the issuing of non-binding guidance to support the END's implementation by the EC (or the EEA).

Whilst it is clear that measures should be included within NAPs, different MS have interpreted differently whether they are actually required or expected to implement measures. This is a good example of the difference between the legal requirement themselves, where it is clear that the implementation of noise abatement, mitigation and reduction measures within NAPs are only voluntary and practical interpretation difficulties, such as competent authorities gaining the impression that they have to implement measures, where translations of the legal text into another language may result in different interpretations and understandings of the requirements. Here, it is worth referring back to the earlier point raised under 'relevance' that some confusion reigns among some END stakeholders because the END includes an implicit reference in the recitals to reducing noise, but there is no explicit objective in this regard. It is likewise implicit that MS should ideally implement measures rather than explicit.

In relation to **obsolete provisions**, Art. 7 (strategic noise mapping) refers to agglomerations in R1 with more than 250,000 inhabitants, whereas the definition of an agglomeration in Art. 3 refers to the definitive threshold of 100,000 inhabitants. References to the transitional period of END implementation could be deleted in any future codification and updating exercise.

EQ6 To what extent is the Directive sufficiently clear in setting out the obligations of Member States at the level of (i) the Competent Authority and (ii) other stakeholders involved in national implementation?

Whilst Art.4 makes clear that each MS should designate CAs responsible for END implementation, in particular in relation to the preparation and developments of SNMs and NAPs. However, the Directive is not prescriptive as to how they should organise **national administrative arrangements**. The research found evidence that most EU MS appreciate the flexibility (under subsidiarity) to determine how they should organise END implementation at national level.

However, some national CAs would prefer there to be greater clarity in the END as to how national implementation arrangements should operate, the role of different stakeholders within the END etc. since they have experienced practical difficulties in coordinating arrangements effectively, and in determining sub-national administrative arrangements for END implementation. The research found that this has led to delays in the provision of reporting data and information by local to national levels of administration and in particular to the national CA responsible for data collection and collation. This in turn led to delays in the submission of such reporting data to the EC. A further problem was the lack of national enforcement capabilities to require designated CAs to produce SNMs and NAPs, especially at local level.

There was a perceived lack of clarity in the legal text as to what reporting information and data, public authorities responsible for mapping and action planning at a sub-national level must provide to national CAs responsible for collecting the data. The absence of details as to which other organisations should help to support END implementation was not seen as problematic. For instance, local authorities not directly involved in noise mapping and action planning themselves were generally willing to provide input data where available.

Effectiveness

EQ7 - What progress has been made towards achieving the first objective of the END?

Significant progress has been made towards achieving the first objective of the END (defining a common approach). The research has shown that greater progress has been made towards the first than the second objective of the END (informing source legislation).

Progress has been made through the adoption of a **common EU-wide approach to noise mapping** (**(Art. 1(1a))** initially using national and interim methods) and action planning and through the subsequent development of the CNOSSOS-EU common noise assessment method to replace Annex II. However, whilst the publication of the revised Annex II in Commission Directive (EU) 2015/996 was a major milestone towards a common approach, it will only be implemented across EU-28 from Round 4 (2022), which means that some aspects of the goal of attaining a common approach can only be realised over the longer-term.

Less progress has been made in respect of the achievement of **a common approach to assessing health effects** (i.e. relating to Annex III of the Directive). Work by the EC commenced in 2014, but the timing of the development of the assessment method for determining source-specific dose-response relationships required is dependent in turn on the timing of the finalisation of WHO guidance on dose-response relationships. The EC expects to make considerable progress in the next two years in this regard.

Strong progress has been made in **making information publicly accessible (Art. 1(1b)).** Most SNMs and NAPs were found to have been published online R1 and R2, although the research found that R1 SNMs and NAPs were more readily available online than in R2 to date. This may reflect the considerable delays in some countries in R2 in finalising key reporting information, submitting it to the EC and publishing it online.

A common approach to **noise action planning** (**Article 1(1c))** has already been achieved, albeit mainly in terms of all MS going through a common process to produce a NAP, whilst adhering to the minimum requirements of a NAP outlined in Annex V and undertaking a public consultation. The research identified major differences between countries in terms of how they have approached action planning (from strategic to operational approaches) and as to whether they have identified expenditure measures, other types of measures, or a combination of the two.

Nevertheless, divergence in approaches but following the same common broad framework were seen as reflecting the spirit of subsidiarity which should guide the END's implementation. One aspect where less progress has been made is in respect of the financial information section relating to NAP implementation required under Annex V. In particular, a key finding was that there is often a lack of data on the costs (and especially the benefits) of noise mitigation measures.

In terms of the **speed of progress**, there is no formal defined timeline in the END for the achievement of a common approach. Whilst some national CAs were found to be disappointed that CNOSSOS-EU could not be implemented earlier, others requested the extra time in order to allow them to make the transition from using national and interim assessment methods.

EQ8 - What progress has been made towards achieving the END's second objective?

Good progress has been made towards the END's second objective (Art. 1(2) of "providing a basis for developing Community measures to reduce noise emitted by the major sources". However, this objective was found to be less concerned with developing *new* measures, and more concerned with informing the revision and updating of *existing* source legislation, since some transport sources covered by the END (i.e. major roads and major airports) were already subject to source legislation. An exception in this regard was the adoption of the TSIs in the railways sector, where some new developments have occurred in addition to the updating of previous rules and the extension of their scope (e.g. from new rolling stock only to existing rolling stock).

The legal mapping found that since 2014, when a number of pieces of existing source legislation were revised (in respect of airports and the automotive sector), the impact assessments and recitals to the revised source Directives[169] have made strong references to the END as providing a strategic reference point for source legislation. They also emphasised the future importance of END data on population exposure in informing the monitoring of the implementation of source legislation.

Until the revised Annex II (Commission Directive (EU) 2015/996) is fully implemented, however, END data is not yet comparable between rounds or countries, and the evidence shows that this will directly influence the timescale over which the second objective of the END, of providing a basis for determining source legislation, is likely to be achieved.

The achievement of harmonised and comparable population exposure data through noise mapping under the first objective was regarded as a precursor for END data to be utilised by EU policy makers to inform the revision of existing EU noise at source legislation. Although some END stakeholders involved in national END implementation believe that the data is already sufficiently robust to be used to inform the development of source legislation, the research showed that policy makers themselves have not yet used END data. They stated that they are unlikely to do so until the issues of data comparability and data completeness have been addressed.

EQ9 - What are the main impacts of the Directive?

The impacts of the END to date were assessed both qualitatively (under this EQ) and quantitatively (EQ13), the latter as part of the measure-level case studies and the cost-benefit assessment (CBA). Impacts are considered in relation to several sub-questions.

EQ9a - How far has the Directive achieved any significant changes (positive or negative)?

Key findings were that many stakeholders attested to the END having had positive, non-quantifiable effects over and above measure implementation. These include: (i) promoting a more strategic approach to environmental noise management, mitigation and reduction through action planning (ii) strengthening the visibility of environmental noise (iii) raising awareness about the adverse health effects of high levels of noise at receptor and among policy makers (e.g. transport planning, infrastructure development, urban development and planning) about the importance of incorporating environmental noise mitigation from the outset and (iv) promoting "joined-up" working between different stakeholder organisations at national, regional and local levels, who might not have previously cooperated together prior to the END.

The END was found to be primarily driven by the collection of data and information on a common basis that can subsequently be used for different policy-making purposes at EU level (with indirect benefits for policy makers and public officials at national, regional and local levels). For EU policy makers, a clear impact of the END is that noise maps are now available by source which provide population exposure data. This is useful for assessing the effects of existing source legislation and for considering its potential revision (subject to data comparability issues being addressed). The END has made noise data available that provides a means to monetise the impact of noise, for determining the overall environmental burden of disease (see the CBA findings in EQ13).

The data also has indirect benefits for national and sub-national policy makers (even if that is not the primary purposes of the END), since the maps and exposure data can help to prioritise environmental noise interventions domestically. Evidence was also found that some national authorities are utilising END data and approaches to action

[169] See for instance the recitals and impact assessments for Regulation 540/2014 (motor vehicles), Regulation (EU) No 598/2014 (airports) and Regulation 1304/2014 and Regulation (EU) 2015/429 (both TSIs on railways)

planning to benchmark their performance and own approaches to noise mitigation and abatement at receptor. Lastly, the END has also made information about the level of noise exposure by 5dB band (from road and rail in particular) available to EU citizens (who previously had little or no access to information of this type).

EQ9b - Has the Directive contributed to ensuring that by 2020 noise pollution has significantly decreased?

The END was found to have contributed to reducing noise pollution (and the associated objectives set out in the 7th Environmental Action Programme). There are well-documented uncertainties relating to attribution factored into the CBA (see EQ13 and Annex E, which explains the methodology for the CBA in detail). It was consequently difficult to establish the precise percentage contribution of the END. Moreover, at an EU level, there is an absence of data collection through reporting systems on measure implementation across the EU as a whole. This makes it difficult to obtain a comprehensive overview as to which measures identified in NAPs have gone ahead in full, partially or not at all and thus to determine the extent to which the estimated benefits can be attributed to the END.

Notwithstanding, the END was found to have made a positive contribution to decreasing noise not only through measure implementation but also by raising the visibility of environmental noise on the domestic policy agenda, such that central, regional and local governments have given greater attention to the problem through expenditure programmes in relevant government departments (e.g. infrastructure development, transport) in some countries. In some cases, noise mitigation actions have been established within transport and infrastructure planning programmes that might not have gone ahead were it not for the END.

The findings from the test case data suggest that END measures have made a valuable contribution to reducing population exposure, although for some types of measures, the net benefit can only be fully assessed in subsequent mapping rounds, since (a) the full benefits can take a significant period of time to materialise and (b) the test cases have assumed complete implementation of measures identified in the NAPs and for which cost and benefit data was available.

The analyses conducted in the 19 test cases revealed that there has been a positive impact on noise reduction measured in terms of the change in the size of the population exposed to noise by 5dB class due to measure implementation. The level of magnitude of the reduction by source is set out in the table below, which is taken from the detailed case study work (see EQ9b and also Annex F, which sets out the case studies in full).

Table 4.1 - Change in the size of the population exposed to noise due to case study measure implementation

Change in the size of the population:	Major roads (n=2)*	Major railways (n=2)	Major airports (n=5)	Agglomerations (n=6)
Annoyed	40,777	7,924	27,356	74,440
Highly annoyed	18,685	3,256	12,833	38,859
Sleep disturbed	22,037	2,228	19,593	38,479
Highly sleep disturbed	10,044	1,020	12,312	18,710

** n = number of case studies from which the estimates are derived.*

EQ9c - Can any unexpected or unintended consequences be identified?

The research did not uncover many unexpected or unintended consequences.

An example of an **unexpected effect** of the END is that it has stimulated stronger interest among MS in quiet areas in urban areas (agglomerations). There is evidence of increased research interest in the urban soundscape as a result, as shown in the assessment of the research topics of projects funded through FP6, FP7 and the LIFE programme (*see Appendix I - Assessment of Utility of EU Funded Research Projects on Environmental Noise).*

An example of a further positive unexpected effect was that in some MS, END data has been integrated into other datasets, for instance in the health field. END data has been used to feed into epidemiological studies to assess the health impacts of high levels of noise exposure in tandem with other health variables.

There were concerns that END data might be used for purposes that it was not originally designed for, with a risk of unforeseen consequences. For instance, it may not be clear to end users (especially individual citizens but also less well-informed NGOs) that there are assumptions and limitations in the data. For instance, the research has shown that it was not always appreciated that END data is often based on a computerised projection based on an average metric over 12 months rather than on *actual* noise levels. Whilst in some EU countries, this potential problem was actively managed by producing FAQs, no evidence was found that the misinterpretation of END data was a major problem.

EQ9d - To what extent can impacts be quantified?

It is too early to assess the full range of quantitative impacts of the END, particularly through the implementation of measures, because many measures identified in NAPs have not yet been implemented, but also because of the long-term time horizon over which benefits materialise (25 years was assumed in the CBA). However, through the CBA, a preliminary assessment of impacts was undertaken (see EQ9b which examines how far the END may lead to a reduction in noise by 2020 and EQ13, which sets out the CBA findings, and provides a monetised assessment of the health benefits).

EQ10 - How have the provisions of the Directive been accepted by the stakeholders?

The research examined the extent to which each of the following END provisions been accepted by stakeholders:

- Noise measurement through a system of common indicators and a common methodology (CNOSSOS-EU) being implemented in future through Commission Directive (EU) 2015/996);
- Noise mapping;
- The preparation of noise action plans;
- Information and consultation of the public; and
- Reporting to and by the EC / EEA and reporting under Art. 11.

The evaluation findings were that the three actions required under the END, as set out in Art. 1(1a, 1b and 1c) of the Directive relating to noise mapping, information and consultation with the public and action planning respectively are **widely accepted by stakeholders.**

Although some END stakeholders were initially reluctant to make the transition to producing SNMs using a common approach based on the revised Annex II, there was an acceptance that this would be necessary to strengthen the availability of data at an EU level of high levels of noise and to strengthen comparability in future.

The L_{den} and L_{night} indicators have been welcomed by stakeholders, since these provide a common basis for collecting noise exposure data on affected populations within scope by source across the EU. Even if some MS have decided to retain the use of additional national noise indicators, they can see the value of common noise metrics (e.g. allowing MS to benchmark with one another, better assessing the net impact of source legislation on noise at receptor).

The process of action planning – including the public consultation dimension – is widely accepted by END stakeholders. Indeed, the research found that the END plays a positive role because it provides a formal mechanism through which they can undertake community engagement. The reporting requirements to the Commission, as required under Art. 11, were accepted and generally regarded as administratively proportionate, although a small number of stakeholders questioned whether quantifying population exposure down to a precise number of inhabitants is in keeping with the concept of a *strategic* approach to noise mapping.

Efficiency

EQ11 - How far are the administrative costs of END implementation proportionate? To what extent does the level of administrative costs vary?

The administrative costs of END implementation at EU and national level are mainly incurred in carrying out the three activities of a) strategic noise mapping, b) making data and information *publicly accessible* and c) noise action planning. All three activities contribute towards achieving objective Article 1(1). In addition, other types of costs may also be incurred, such as human resources linked to overall coordination at national (and / or regional level), the costs of collecting data from different CAs at national level and the costs of reporting data and information to the EC.

The Costs of Strategic Noise Mapping

Although it was challenging to obtain a complete, consistent, and comparable dataset across all EU-28 MS, the cost data that was obtained identified considerable heterogeneity in costs. This reflects the fact that under subsidiarity, very different implementation approaches are being adopted. The level of costs varied significantly between EU MS and was dependent on country size and total population, as well as on the type of implementation approach adopted (i.e. whether more centralised or decentralised noise mapping, etc.). Based on 23 EU MS for which national CAs provided data, the total cost of END implementation (focussing on noise mapping and action planning) amounted to at least € 75.8m in R1 and in R2. When extrapolated to EU28 level, the calculated figures are €80.3m in R1 and €107.4m in R2. This increase can be considered moderate given the increased scope of noise mapping and action planning required in R2.

The average estimated costs of noise mapping spread across the total population were €0.18 / capita (with a median of €0.15). The costs per affected inhabitant are higher, estimated at approximately €0.50 up to €1.00, depending on the MS.

The costs of procuring noise mapping services were lower in R2 than in R1 in many (although not in all) EU MS, reflecting greater experience among CAs in managing the procurement of noise mapping and greater competition among contractors, and the impact of the economic and financial crisis, which has had ongoing negative budgetary implications for END implementation in at least several EU MS. The trend towards lower mapping costs in R2 was in spite of an overall increase in the volume of noise mapping, due to the transition to the definitive R2 END thresholds.

The costs of action planning

Action planning costs also appear to have been reduced between Rounds in some EU MS, but this was more difficult to assess due to the lack of data on the costs of noise mapping, since this has relied on MS being able to assess accurately how much civil servant time CAs had spent on action planning. Since many different public authorities were often involved in action planning, and it was not common to monitor the time spent on such activities (including the public consultation dimension), it was only possible to estimate human resources in a small number of MS.

Insofar as cost data was available, there was also **considerable variance in respect of the costs of noise action planning.** As far as the level of human resources dedicated to END implementation were concerned, there was considerable variance, with a wide range in the estimated number of FTEs involved in END implementation (covering all activities). For instance, the number of FTEs in R2 ranged from 0.1 in Malta and 0.35 in Cyprus to as high as 196 in Germany. The costs were influenced by a similar range of factors to noise mapping, such as population size and the implementation approach adopted. The average costs of action planning per capita (based on total population size rather than END coverage only) were only €0.06 per capita (with a median of €0.03).

The general downward trend in administrative costs was attributed to the fact that the legislation has become better embedded and the fact that in R2, there were no longer any one-off compliance costs, for instance, those associated with familiarisation with the END's requirements, IT equipment and software purchase, etc. Some stakeholders however pointed to additional one-off compliance costs in future, when recalibrating noise calculation models to implement Commission Directive (EU) 2015/996.

Although the **reduction in administrative compliance costs between rounds** can be interpreted positively, the research through the interview programme found that some CAs have simply cut the budget available for END implementation in R2. This doesn't necessarily mean however that they have become more efficient at implementing the END, but rather that they have allocated less human and financial resources, which was found to sometimes have had adverse consequences from the perspective of efficiency *(e.g. the timeliness of SNM and NAP completion and data and information submission)* and effectiveness *(e.g. the lack of a complete EU-wide dataset, which risks undermining the achievement of the second objective of the END, informing source legislation).* There were however positive aspects in a small number of EU MS where the financial crisis has led authorities to focus more strongly on identifying cost savings (e.g. through more competitive procurement procedures).

Since the END is implemented under the subsidiarity principle, with evidence of very different approaches being adopted by different EU MS, it is not possible to compare the cost-effectiveness of these different implementation approaches. This is partly because the approaches are so different, which means that the cost-benefit ratio between the **inputs** *(i.e. human and financial resources mainly focused on action planning and noise mapping)* and the **outcomes** is not straight-forward**.** The benefits can be assessed quantitatively through measure-level assessment of costs and benefits, which is an important proxy of the Directive's efficiency. However, it does not capture the totality of costs and benefits which necessarily must take into account qualitative benefits.

The proportionality of the costs

Perceptions of the costs of END implementation were found to vary considerably among END stakeholders. In some MS, smaller municipalities viewed noise mapping as a costly exercise, but this was primarily because they do not receive a specific budget line for noise mapping from national government, and the budget has to be identified from their general budget. The costs of noise mapping were in the views of some NGOs interviewed quite high and risked detracting from measure implementation.

However, other stakeholders pointed out that whilst there are costs in the shorter term, over the medium – longer term, the costs of noise mapping should be only a fraction of the substantive compliance costs associated with the implementation of measures identified in NAPs. Another important point in relation to perceptions of costs was that not all national stakeholders understood the longer-term strategic benefits of the END in relation to informing source legislation (as set out in Art. 1(2)).

Stakeholders broadly agreed that the benefits of the END outweighed the administrative costs. However, whilst the majority of stakeholders viewed the costs of noise mapping / affected inhabitant are proportionate to the costs, where mapping takes place that covers a smaller unit (for instance, in smaller municipalities), the costs of mapping / inhabitant may be higher relative to the size of the affected population, since there are minimum costs of procuring consultants to carry out the mapping irrespective of the affected population covered, and conversely economies of scale to be realised when choosing fewer, larger units for mapping).

When the costs of END implementation are examined in aggregate across EU28 as a whole, the costs of noise mapping and action planning were estimated to be approximately €80.3m (R1) and €107.4m (R2). These costs were found to be proportionate relative to the total and the affected population, given that these costs are spread across a five year cycle and given the scale of the health challenges posed by environmental noise (see the findings from the CBA.

Although the costs were still low per affected inhabitant and per capita (among the total population), the research identified a difference of several times depending how particular MS have decided to implement the END. For example, the range in terms of the cost per capita was from €0.05 in the UK to €0.56 in Slovakia.

The assessment of whether administrative costs are proportionate needs to consider the (potential) benefits to be realised as a result of END implementation. It should be emphasised that these benefits relate not only to measure implementation, quantified in the CBA, but also to the qualitative benefits of adopting an EU-wide approach to environmental noise management identified in EQ9a *(e.g. heightened visibility of noise at receptor across different policy areas, a more strategic approach at national level, greater cooperation across a spectrum of different policy areas that have relevance to environmental noise).* The benefits associated with measure implementation were addressed in EQ9b (the contribution of the END to reducing noise by 2020) and in the CBA in EQ13 (cost-effectiveness of the END).

At the request of the EC, the focus was on an assessment of the cost-efficiency of measures identified in NAPs that have been implemented in R1 (see EQ13 (cost-effectiveness of the END). However, such cost-benefit ratios at the measure level, whilst an important proxy, are different from the question of assessing the cost-effectiveness of the Directive overall. The latter necessarily requires taking into account the quantitative and qualitative costs and benefits of the END. The qualitative benefits identified through the research[170] were summarised in the impacts section (see Section 3.2.3.7 – impacts of the Directive).

In other words, the administrative costs associated with activities required through the END (e.g. noise mapping and action planning), are processes that have a number of qualitative benefits associated with them and these also need to be taken into consideration in order to form an evaluative judgment of cost-effectiveness at this stage in the Directive's implementation.

[170] Examples are a more "joined up" and coordinated approach across different policy areas at national, regional and local level to environmental noise mitigation, abatement and reduction, a more strategic approach to the management of environmental noise etc.

Assessing the END's full cost-effectiveness is not possible at this stage of implementation[171], since there remains some way to go in the implementation trajectory before comparable data is available to inform source legislation (Art. 1(2)). The longer-term benefits of the END have yet to be fully manifested. Nevertheless, it can be concluded that there is already a favourable cost-effectiveness relationship between the costs, which have been quantified in terms of financial and human resources, and the benefits[172] associated with noise mapping and action planning. These benefits have been assessed both quantitatively (see CBA) and qualitatively (see impacts section).

EQ12 - To what extent is the END reporting mechanism efficient?

This question looked only at the efficiency of the END Reporting Mechanism, mainly the use of the Reportnet, since this was the submission mechanism currently being used by the majority but not all other EU MS. Other important issues, such as the timeliness of data availability and its utility in informing source legislation, and whether there are gaps in the types of monitoring data and information being collected in the ENDRM are examined instead under 'effectiveness'.

The Reportnet system developed within the EEA's EIONET to collect data and information on END implementation from MS was found to be a useful reporting mechanism but one which is not yet fully efficient.

The research found that most national CAs were satisfied with the guidelines issued and reporting templates produced by the EEA as to how to use. However, less positively, the Reportnet system within the ENDRM was viewed as being insufficiently user-friendly. Several stakeholders stated that it had taken them a lot of time to upload all the required reporting data, and that particularly for action plan summaries, there were many data fields to be completed. Perceptions as to how resource-intensive the transmission of reporting information was were dependent on the level of resourcing available for END implementation at national level more generally, since the national CAs responsible for reporting in some MS have a very large number of SNMs and NAPs to upload and only limited human resources to work on END coordination and EC reporting.

More positively, the database on SNMs maintained and updated and published periodically online by the EEA and the EIONET website's Noise Viewer tool provide an efficient means of making reporting information and data publicly accessible. Among the less efficient aspects of the reporting system identified were that it is difficult to extract EU-level reporting information in respect of NAPs and there are too many data fields for the NAP summaries.

Notwithstanding the limitations noted earlier, the outcomes of the assessment suggest that the END is efficient overall when the benefits of measures implemented to reduce noise levels are considered. The NPV is positive under all scenarios (base case, best and worst case) and only negative for airports and roads under the worst case scenario. Under the base case scenario, both the NPV and cost-benefit ratios are positive, with an aggregate return on investment of approximately 29 EUR for every 1 EUR spent (excluding agglomerations).

[171] A time-based trajectory illustrating the point that the full and effective implementation of the END and the realisation of its objectives will take time (see EQ7 – progress towards objectives in Section 3.2.3 - Effectiveness and impacts).

[172] The quantitative benefits of the END linked to measure implementation were explored separately through the CBA and since these measures are non-obligatory, cannot be directly compared with administrative costs.

It was not possible to assess agglomerations in the same way as major roads, major railways and airports but detailed investigation of a range of typical measures applied in agglomerations suggests that the benefits of END implementation are likely to significantly outweigh the costs even though the cost-benefit ratios vary widely between measures.

EQ13 - To what extent does the Directive demonstrate cost-effectiveness based on an assessment of the costs and benefits to date?

Overall, the END appears to be cost-effective in that the benefits are likely to outweigh the costs over time. There are challenges in assessing the benefits at this early stage of measure implementation, given the long-term nature of many noise mitigation programmes and measures.

The administrative costs of END implementation have declined on a "like for like" basis in R2 compared with R1 (i.e. the total costs have remained steady but the volume of mapping and action planning have increased). The cost curve in implementing new legislation is centred on the initial stages of implementation (including one-off costs) whereas the benefits of bringing about a common, harmonised approach to noise mapping through a common assessment method will only materialise in full over the longer term. The costs of implementing noise abatement, mitigation and reduction measures identified in NAPs are likely to significantly exceed the administrative costs, in common with most EU legislation (where substantive costs frequently exceed administrative costs).

The benefits of measure implementation will only fully materialise after the end of the implementation lifecycle and are likely to extend for many years into the future. Notwithstanding, at this stage, there appears to be a favourable cost-benefit ratio for most types of noise mitigation measures, although there is variation as to the level of benefit, depending on whether a worst-case or best-case scenario is applied.

The level of benefit is dependent on taking attribution into account. Determining an appropriate attribution ratio is not straight forward due to the nature of the END, which is dependent on MS implementing measures at national, regional and local level through NAPs but using national funding sources. There is a perception that many measures have at least some form of national dimension.

The test case findings suggest that the benefits of END implementation exceed the costs of measures for all noise sources, and under a range of scenarios, the costs and benefits per person vary significantly and will depend on a number of factors including population density, background noise levels, traffic composition and the degree of maturity in addressing noise issues (which in turn will influence the selection of measures and background noise levels).

The total present value costs (including costs of implementation linked strictly to the END as well as costs of measures) across the EU-28 (excluding agglomerations) range from around €480 million to €30.8 billion over a 25-year period while the total present value of benefits (again excluding agglomerations) range from €8.5 billion to €157 billion. It should be noted that this due account should be taken of the data limitations and the assumptions applied.

The analysis of the relative costs and benefits of a number of typical measures suggests that the benefits of END implementation are likely to significantly outweigh the costs even though the cost-benefit ratios vary widely between measures.

EQ14 - What has been the overall EU added value of the Environmental Noise Directive?

EQ14a - What has been the overall EU added value of the Environmental Noise Directive?

The END has delivered European Added Value (EAV) by putting in place a common legal framework across the EU. Many MS did not have national environmental noise legislation prior to the adoption of the END**.** 15 MS were found to have no national environmental noise legislation in place prior to the END's adoption. Especially in the new MS (e.g. **EE, LV, LT, RO, SK and SLO),** the existence of an EU Directive on environmental noise has added value, since this required national legislation to be developed.

The END has also made a significant positive contribution to raising awareness among national, regional and local policy makers, politicians and the wider public about the importance of environmental noise as a policy issue and the extent of the problem.

EQ14b - To what degree were EU Member States already carrying out noise mapping prior to the END and how far were mitigation measures already in place?

Almost half of all EU MS had no environmental noise legislation in place prior to the adoption of the END. However, through the research, those MS that did have such legislation were identified (these include, for instance, **DE, DK, FI, FR, IE, IT, LU, NL, PL, PT and the UK)**.

Some of these MS were already carrying out noise mapping prior to the END. However, the data and maps were not always made available to citizens. However, noise maps were not produced on a common basis across the EU, so it would therefore have been very difficult for source policy makers to systematically use the data and maps to inform source legislation.

In terms of the existence of mitigation measures prior to the END, many of those MS that had national legislation already were also found to have long-established noise mitigation schemes in place (**e.g. AT, DE, DK, NL and the UK).** Some of these were established a long time ago and their period of implementation may extend over 20-25 years, reflecting the long-term challenge of tackling noise at receptor. National regulations were the key drivers of measures, and some measures were already well-established by the time the END was adopted.

The mitigation measures already in place have been continued under the END. In general, these have been continued on the same scale, although some examples were found as to how the heightened visibility of environmental noise within the END had increased the scale of funding. In countries that did not have any such legislation before the END, there were generally no mitigation measures because the issue was not on the domestic policy agenda as being a serious problem. In these countries, for the CBA, we have therefore assumed a much higher level of attribution.

Among stakeholders in countries that already had national legislation, however, there remains a perception that the END is only partially responsible for measures identified in NAPs that have been implemented. An important finding from the evaluation is that it is often not the END alone but rather the END in combination with existing national legislation that has triggered positive developments in noise reduction.

EQ15 - Do the issues addressed by the Directive continue to require action at EU level?

The research has clearly shown that the different components of a common approach will take time to achieve. The research found evidence that the objectives of the Directive will only fully achieved after 2020.

This was the case for both the END's objectives, but was particularly the case for informing source legislation, which is dependent on harmonised data produced on a consistent and comparable basis. Achieving the Directive's objectives will therefore require an ongoing commitment by the EC in its coordination and monitoring role, and by the MS, who are responsible for implementing CNOSSOS-EU across EU-28 from R4. There is strong support for continued action at EU level since the process of defining and then subsequently implementing a common approach requires a long-term approach to achieve this objective.

EQ16 - Are there are any ways in which the European added value of the END could be further enhanced?

A number of suggestions were made by END stakeholders as to how the END might be enhanced, such as: ensuring improved data completeness by ensuring that MS submit strategic noise maps and population exposure data and noise action plans on a more timely basis to the EC, which would help to maximise the value added of EU reporting (such as the EEA's Noise in Europe report) and also be useful for source policy makers, who were reluctant to use the data so far and attributed this partly to lack of data completeness. In addition, added value was expected to be enhanced once the CNOSSOS-EU common noise assessment method has been fully implemented so as to strengthen data comparability between rounds. Being confident in the longitudinal comparability of the data is crucial if policy makers responsible for source legislation are to assess the scale of the problem and to assess the (net) benefit of limit values set in existing source legislation.

Although some stakeholders were found to be in favour of introducing limit values at receiver in the END, there was however no clear consensus as to whether in future EU noise limit values at receiver would help to enhance the Directive' added value. There was however greater support for setting broad, non-mandatory targets for noise reduction either at an EU level or specific to individual MS depending on their relative baseline situation in respect of environmental noise levels.

EQ17 - What would happen if the END were to be repealed?

If the END were to be repealed, the research findings point to a number of negative consequences, such as the fact that there would no longer be a common approach to noise assessment methods and to undertaking mapping.

Most MS would largely revert to using their own national methods of noise mapping and action planning, even if they may continue to report using L_{den} and L_{night}. This would make it difficult for EU policy makers responsible for source legislation to assess the net effect of existing source legislation (including source-specific limit values). In addition, there is a clear risk that environmental noise would become less of a priority among national policy makers compared with other environmental concerns, such as air quality, tackling climate change.

Although some noise mitigation measures would still go ahead anyway because measures identified in NAPs were driven by national or other EU regulations (e.g. the Air Quality Directive) or there were other drivers, such as introducing speed limits to reduce pollution and to comply with EU air quality limits and national regulations (e.g. on aircraft noise and mitigation). However, at least some measures would no longer be supported were the END to be repealed. This would potentially lead in future to a higher

number of exposed persons to environmental noise, with significant adverse implications for the health and well-being of those affected by noise as a result.

Since measures often take time to fully implement, and the benefits resulting from measures already implemented under the END (and those that have begun implementation) typically take up to 25 years to fully materialise, it does not seem advisable to repeal the Directive, when the main benefits of measures have yet to be realised.

EQ18 - Is the scope of the Directive (as laid down in Art. 2) appropriate or does it need to be modified?

The scope of the END, as defined in Art. 2 was found to be broadly appropriate, although it remains unclear why schools and hospitals are within the scope of the Directive, since they are not addressed elsewhere in the legal text.

The scope of the Directive in terms of the sources of environmental noise that it covers (i.e. transport noise and industrial noise) could perhaps also be defined as part of this Article (they are presently incorporated as part of the objectives of the END). Most stakeholders agreed that the sources that the END covers are appropriate, although a minority of stakeholders argued that it would be more coherent if the END only focused on transport noise rather than industrial noise. The consensus however was that it remains appropriate to also include industrial noise within agglomerations.

EQ19 - Are there gaps where further EU noise legislation is required in order to achieve the objectives of the Directive?

The research did not identify any major areas not already covered where new EU legislation on noise at source could be required in order to achieve the END's objectives. As noted earlier, the main role of END data collection is to better inform *existing* source legislation through noise mapping results to produce comparable population exposure data.

EQ20 - How could the efficiency of the END Reporting Mechanism be improved?

The research identified a number of ways in which the efficiency of the END could be improved. This was a future-oriented question and a number of possible means of improving efficiency were identified, relating to how to improve reporting processes through the possible elimination of some steps to streamline the process. It was suggested that the RM would be more efficient if all MS used the same reporting system. The specific suggestions made are outlined in Section 4.3 (future perspectives).

4.2 Overall Conclusions

The overall conclusions are now set out, grouped according to each of the different evaluation criteria of *relevance, coherence, effectiveness, efficiency* and *EU added value*. These have been structured drawing on the key evaluation findings by EQ outlined in Section 4.1.

4.2.1 Overall conclusions

The overall conclusions are now presented by evaluation criterion:

4.2.1.1 Relevance

The two objectives set out in Article 1 of the END were found to remain strongly relevant. In relation to the first objective [Art. 1(1)], there is a continuing need for a "common approach" to the assessment and management of environmental noise, since the collection of adequately harmonised population exposure data at EU level remains a

pre-requisite for informing existing EU noise at source legislation. The second objective of the END [Art. 1(2)], relates to providing a basis for developing EU source legislation and also remains highly relevant, given that tackling the problem of high levels of environmental noise will only be possible through combined action on noise at source and through action on noise mitigation and abatement at receptor. Most importantly, the focus in the description of Art. 1(1) on defining a common approach intended to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise, overlooks the importance of explicitly mentioning the need to implement this common approach in a consistent manner across EU-28.

Given the adverse health effects attributed to high levels of exposure to noise at the receptor, the relevance of the END could be further strengthened by making clearer what the longer-term objective of the Directive is relating to public health. Although this is implicit through references in the recitals to ensuring a high level of protection of the environment and public health, it remains highly relevant to European citizens and society as a whole but is as yet an objective that is unclear unstated in the core text of the Directive.

The study conclusions are now summarised.

Conclusion 1: The first objective [Art. 1 (1)] of the END, that of defining a common approach to the assessment and management of environmental noise remains relevant. However, given that significant progress has been made in defining a common approach, it could be made clearer that the focus in future should be on implementing a common approach in a consistent manner within and between MS.

Conclusion 2: The second objective of the Directive [Art. 1(2)] remains highly relevant, in particular to informing EU policy-making in respect of the development of new, and the revision of existing EU source legislation.

Conclusion 3: It is unclear what the longer-term objective of the END is, since this is implicit, rather than explicit in the legal text. This could be made more explicit if the Directive is reviewed and updated in future, for instance by making it clearer that the aim is to protect citizens from the negative effects of excessive noise from transport and industry.

4.2.1.2 Coherence

The Directive was viewed as being generally 'internally coherent'. There were however a number of definitions (e.g. agglomeration, quiet areas in open country, quiet areas in an agglomeration), that either need to be better defined, or alternatively clarified in supporting interpretative guidance. A further finding is that minor changes are needed to the END's legal text so as to ensure greater consistency in the different articles and sub-articles (e.g. draw up vs. adopt a Noise Action Plan). This could potentially reduce the scope for differences in interpretation between MS.

With regard to 'external coherence', the END was seen as being strongly coherent with EU noise-at-source legislation and other relevant EU legislation (environmental legislation and legislation on industrial machinery). Most stakeholders did not perceive there to be any overlap or duplication between the END and other EU legislation.

With regard to impacts, a number of benefits from the Directive's implementation to date were identified, such as promoting a more strategic approach to noise management, mitigation and reduction, heightening awareness among policy makers in relevant areas (e.g. transport planning, infrastructure development, urban development and planning) about the importance of environmental noise and its mitigation, among others. In addition, a number of quantifiable benefits from measure implementation were identified through the CBA (see efficiency).

Conclusion 4: The Directive is generally 'internally coherent', although a detailed review of the legal text by the EC is needed to review the issues identified in this report to ensure that minor inconsistencies are addressed.

Conclusion 5: The Directive demonstrates strong 'external coherence' with other relevant EU legislation. There do not appear to be any contradictions or inconsistencies between the END and other relevant EU legislation.

Conclusion 6: The process of updating existing source legislation to take the END into account (e.g. in the recitals, END population exposure data) is necessarily an ongoing one, since source legislation is typically updated only once every 10-15 years. Nevertheless, in the previous five years, several key pieces of source legislation have already been revised.

Conclusion 7: Since other regulatory developments have taken place at EU level since the END was adopted (e.g. adoption of the INSPIRE Directive, the Lisbon Treaty), at some point in future when the END is updated, there will be a need for a legal codification exercise to ensure that the Directive reflects broader relevant developments.

Conclusion 8: National noise control legislation was found to be coherent with the END, although there were many practical challenges in the early stages of the Directive's transposition to update and to ensure consistency with national legislation in those 13 MS that already had such legislation.

4.2.1.3 Effectiveness

Significant progress has been made in respect of the development of common noise assessment methods through the development of the CNOSSOS-EU methodology (by 2012) and the subsequent adoption of Commission Directive (EU) 2015/996 (the revised Annex II). Nevertheless, there remains further progress, in particular in moving beyond the *development* of the revised Annex II to its *actual implementation* (from R4 onwards).

In addition, good progress has been made in bringing about a common approach through action planning across the EU (in spite of wide divergences in implementation approaches under subsidiarity) and in making information publicly accessible. The END has also begun to make progress towards the future development of a methodology to support Annex III (measuring the health effects of environmental noise based on dose response relationships).

However, since the new WHO guidance on dose response relationships has not yet been published, significant progress is unlikely to be made until approximately 2018.

Some progress was also found to have been made towards achieving the END's second objective (Art. 1(2)), '*providing a basis for the development of Community measures to reduce noise emitted by major sources'*. In particular, revised source legislation (and in the case of major railways, also new Technical Standards for Interoperability (TSIs) adopted in the past three years have made reference to the END as a strategic reference point and referred to its explicit role in addressing the adverse health effects of environmental noise in the recitals of updated source legislation and in impact assessments.

However, to date, END noise population exposure data by source has not yet been used by source policy makers, although they have made explicit references (e.g. in impact assessments and in the recitals) to the potential utility of such data in future. The reason why policy makers have not yet appeared to make full use of this data was due to (1) the lack of EU28-wide data completeness and (2) the lack of comparability in the data between rounds and countries. .

The late submission (and/ or non-submission) of reporting information and data by some Member States in both R1 and R2 has undermined the ability of the END to provide comprehensive baseline data to inform source legislation, and also makes monitoring and reporting by the EC and external evaluation of progress more difficult. Moreover, END population exposure data was found to be not yet fully comparable across EU28 or between Rounds, since data produced so far was based on noise mapping results using different national and interim computation methods, noise software, input parameters etc. This issue will however be addressed over time as the transition to the implementation of Commission Directive (EU) 2015/996 gets underway across EU28 (in R3 on a voluntary basis and R4 on a mandatory basis), but until then this remains an area of weakness in the Directive's implementation.

The five year timeframe for END implementation in respect of the activities linked to the achievement of the first objective (Art. 1(1)) appears to be effective. IN a hypothetical situation under which a ten year cycle were instead to be adopted rather than the current five years for END implementation, whilst this could potentially reduce administrative costs, it could equally lead to a loss of expertise and technical capacity at both an individual and organisational level. Data collected on the number of full-time equivalents (FTEs) involved in each END implementation round has shown that only a small number of people work on END implementation. This means that their experience and expertise is highly concentrated. However, the one year timeframe between the finalisation of SNMs and the submission of NAPs was found to be too short for stakeholders in many EU MS to meet NAP reporting requirements.

The END was recognised as effective in fully respecting subsidiarity in its implementation in that MS are responsible for setting out their own implementation arrangements. Whilst most MS strongly welcomed this flexibility, some would prefer a more detailed set of implementation arrangements for the national level in the Directive. However, this would clearly be inappropriate for a Directive drawn up and implemented under the subsidiarity principle.

With regard to impacts, a number of non-quantifiable benefits from the Directive's implementation were identified, such as promoting a more strategic approach to noise management, mitigation and reduction, heightening awareness among policy makers in relevant areas (e.g. transport planning, infrastructure development, urban development and planning) about the importance of environmental noise and its mitigation, among others. In addition, a number of quantifiable benefits were identified through the CBA from measure implementation (see efficiency).

Conclusion 9: Overall, the END was found to be an effective means of tackling the problem of environmental noise at receptor.

Key conclusion 10: Considerable progress has been made towards achieving the first objective [Art. 1(1)] of the END, through significant progress on implementation of the three steps within the common approach. However, greater progress has been made in *defining* a common approach to noise assessment methods, whilst progress towards a more consistent approach to implementation will require further time, at least to ensure a harmonised approach to strategic noise mapping with comparable data. In addition, it will take further time to revise Annex III and to develop a common approach to assessing the health effects of environmental noise.

Conclusion 11: Some progress has been made in respect of the second objective [Art. 1(2)] of the END, less in terms of the development of new Community measures, but more through the revision of existing source legislation.

<u>Conclusion 12</u>: Less positively, whilst the Directive has been effective in encouraging source policy makers to take into consideration the adverse health effects of noise, population exposure data is not yet being used systematically.

<u>Conclusion 13</u>: The END has had a positive impact in strengthening attention to environmental noise and the importance of increasing efforts to mitigate and reduce noise due to its adverse health effects at MS level. In at least some countries, this has led to extra public funding being directed towards noise mitigation.

<u>Conclusion 14</u>: The five year timeframe for END implementation appears to be the optimal approach and is effective in ensuring that expertise is not lost and that institutional memory within responsible CAs with regard to managing strategic noise mapping and noise action planning is preserved.

<u>Conclusion 15</u>: The END has been implemented in a way that fully recognises subsidiarity.

<u>Conclusion 16</u>: Enforcement was an aspect of the END's implementation that was found to have been less effective (e.g. lack of effective sanctions or penalties on Member States for the late submission of reporting information and data to the EC, lack of enforcement powers at national level for national authorities to compel local authorities to provide timely reporting data).

4.2.1.4 Efficiency (administrative costs and reporting)

The administrative costs of END implementation (which are associated with carrying out three types of activities linked to the achievement of the Art. 1(1) objective i.e. strategic noise mapping, making information accessible and noise action planning) were found to be proportionate and not overly burdensome. The costs were also found to be proportionate to the scale of the challenge of tackling the problem through an EU-wide "common approach" to the assessment of environmental noise.

For instance, the costs per inhabitant (exposed to high levels of noise) of noise mapping, action planning, organisation and holding of public consultations etc. were approximately €1.50 - €2.00, according to acoustics consultancies, and lower, according to the estimates made by national authorities (although the latter may risk under-estimating the total costs for reasons explained in EQ11 – see Section 3.2.4). The costs per capita among the total population were found to be negligible (e.g. an average of €0.06 and median of €0.03 per inhabitant).

The costs of noise mapping per inhabitant taking the total population as a basis (which seems appropriate given that these costs are borne by public administration overall), is much lower still, amounting to €0.18 in R2 as an average across a sample of 13 MS. This represents good value for money in the view of the evaluators, given the scale of the societal challenge of tackling environmental noise and the importance of strengthening the availability of comparable data on population exposure at EU level in order to inform "Community measures at source". These costs were also viewed as reasonable by most END stakeholders. Less information was available on the costs of action planning since this mainly involves human resource inputs by civil servants). However, the average cost per capita (based on the total population) across a sample of 13 MS amounted to a mere €0.06 in R2, considerably lower than the cost of noise mapping.

Overall, there was evidence of a general reduction in costs between R1 and R2 in relation to other types of (non-staffing) costs. This was attributed to the fact that there were upfront, largely one-off costs of R1 END implementation.

There were found to be wide variations as to the level of human and financial resources that MS have allocated to END implementation overall, reflecting different implementation approaches, and different levels of centralisation and decentralisation. Out of a sample of 13 MS, the cost of noise mapping in R2 ranged from €0.05 to €0.56 per capita, and € 0.01 to €0.29 per capita for R2 noise action planning. A general trend towards reduced staffing levels among national CAs and more generally in R2 compared to R1 can be observed. Likewise, there was found to have been a decline in the costs of noise mapping in many EU MS between Rounds.

Whilst it is clearly positive that the overall administrative costs have generally decreased in R2, there were concerns among some END stakeholders that national CAs need to be allocated sufficient resources by MS governments if they are to implement the Directive in an efficient and timely manner. Insufficient resources, while formally resulting in a reduction in expenditure and hence END-related costs, can undermine aspects of the Directive's effectiveness. For instance, EU policy makers dealing with source legislation have explicitly stated that if the data isn't complete across EU-28, they are not yet able to use END data to underpin impact assessments. This risks undermining the achievement of the second objective of the END (informing source legislation). The lack of resources to ensure the timely commissioning and delivery of SNMs (an efficiency issue) may therefore adversely impact on effectiveness.

Stakeholders interviewed were generally positive about the END Reporting Mechanism. However, the online data entry system for the submission of reporting data and information, and the online summary pro forma for NAPs could be simplified. Relational aspects of the database of SNMs and NAPs could also be strengthened. The CDR was designed as a relational database[173] in 2007, so that there would be linkages between the SNMs and the NAPs. Whilst this is evidently positive in terms of enabling the data and information contained therein to be analysed in a number of different ways, some stakeholders expressed the view that In addition, the research found that there is a need to consider how END data might best be integrated with other datasets in future, including the INSPIRE requirements to make spatial datasets available to the public and also ensuring that SNMs and population exposure available through the Noiseviewer are made available through the EU's open access data portal[174].

<u>Conclusion 18</u>: The administrative costs of END implementation vary considerably between MS, reflecting the subsidiarity principle. The overall costs – especially of noise mapping - were found to have generally declined between rounds, and were cost-effective and proportionate to the scale of the challenges posed by high levels of environmental noise to health.

<u>Conclusion 19</u>: The qualitative benefits (e.g. a strategic approach to noise, heightened visibility of the problem) as well as the quantitative benefits (linked to NAP measure implementation – see CBA findings below) outweigh the costs.

<u>Conclusion 20</u>: The END Reporting Mechanism was found to be efficient in enabling the prompt electronic submission of reporting data by MS once these were available. However, the database itself could be strengthened by strengthening the relational dimension in the databases of SNMs and NAPs.

[173] A relational database is one structured to recognise relations between stored items of information.

[174] https://open-data.europa.eu/

4.2.1.5 Efficiency – cost-benefit assessment

Given the difficulty in quantifying the benefits associated with the explicit requirements of the Directive, the cost-benefit analysis included consideration of the costs and benefits of measures within selected NAPs where at least some R1 measures had gone ahead. This is an important proxy for the assessment the Directive's efficiency and is linked to the ultimate implicit objective of the END which is to reduce exposure to harmful levels of environmental noise.

On the basis of the findings from the cost-benefit analysis focused exclusively on the costs and benefits of measures within selected NAPs where at least some R1 measures had gone ahead. This is an important proxy for the assessment the Directive's efficiency and is linked to the ultimate implicit objective of the END which is to reduce exposure to harmful levels of environmental noise.

Noting the underlying assumptions as well as the limitations of the analysis, it can be concluded that the implementation of the END has been efficient overall. The 19 test cases revealed a high degree of variability in the costs and benefits associated with the implementation of measures to reduce noise. The variability in costs and benefits across test cases may be attributed to a number of factors including the number and type of measures implemented, the size of the noise-affected and beneficiary populations and the influence of local conditions (e.g. topography) on the effectiveness of individual measures. As may be expected, the most cost-effective measures are those that require little capital expenditure and benefit a large number of people (e.g. the imposition of speed limits).

In terms of the situation across EU-28, the base case scenario results in a favourable cost-benefit ratio (of 1:29) overall (including the administrative costs incurred by the European Commission, JRC and EEA) and for each of major roads, major railways and major airports. The overall net present values range between minus €22,334 million (in a worst case scenario) and €156,977 million (in a best case scenario). The differences are largely explained by the underlying assumptions relating to the degree to which costs and benefits can be attributed to the END. Agglomerations were treated separately as it was not possible to obtain sufficiently comparable data across the test cases to support a reliable extrapolation. However, on the basis of an assessment of the typical measures applied in agglomerations, it can be concluded that the benefits of END implementation in agglomerations significantly outweigh the costs even though the cost-benefit ratios vary substantially between measures.

Moreover, the benefits are likely to be somewhat understated as the analysis only considered the effects of noise reductions on the highly annoyed and highly sleep disturbed populations and neither included the impacts on productivity, employer costs and healthcare costs nor the benefits arising from the generation of large and consistent datasets on noise (through SNMs). These have been invaluable in advancing research on the effects of noise on health and productivity and supporting actions in other areas (e.g. development of technical standards, emission levels and other Directives) that have a positive effect on noise levels.

Indirect impacts (e.g. on property values and greenhouse gas emissions) were also excluded from the analysis because of the difficulties in reliably quantifying and generalising these across the EU-28. Meta-analyses of various revealed preference studies suggest that a 1 dB increase in noise levels can reduce house prices by between 0.08 and 2.22% depending on the noise source.

The cost-effectiveness of the implementation of Art. 1(2) was not part of the CBA. It can in any case only be assessed preliminarily at this stage in END implementation. EU policy makers interviewed and those responding in writing stated that they have not used END population exposure data systematically, for instance in impact assessments to justify source legislation, or changes to source Limit Values.

This was partly because of partial data completeness across EU-28 and data comparability issues between rounds. However, they made clear – that they intend to make greater use of END population exposure data in future. Indeed, the commitment to use END data more extensively in future is also stated in the legal text of transport source legislation that has undergone revision in the last 3-4 years particularly (e.g. in the aviation, railways and automotive sectors). A detailed assessment of the relevant legislation concerned was provided in Section 3.2.3.6 (Progress in achieving the END's second objective).

Assuming that population exposure data collected through noise maps is used more extensively in future than it has been to date, the achievement of objective Art. 1(2) should be cost-effective, since the administrative cost data per affected inhabitant are low (estimated by acoustics consultancies at €1.50 - €2.00/ affected person, which includes noise mapping, action planning and public consultations and lower estimated costs by national CAs – see Section 3.2.4 efficiency / EQ11a).

Conclusion 21: A favourable cost-benefit ratio of 1:29 was identified under a base case (most likely scenario) which accounts for the administrative costs incurred by both supra-national authorities (the EC, supported by the EEA) and implementing authorities in MS. This estimate is, however, underpinned by a large number of assumptions which is reflected in the wide range (from 1:0 under a worst case scenario to 1:327 under a best case scenario) within the actual estimate is expected to lie.

A similarly large range was obtained for each of major roads, major railways and major airports. For major roads the cost-benefit ratios vary between 1:0 and 1: 3,341, for major railways they vary between 1:2 and 1:9,474 and for major airports between 1:1 and 1:11. The analysis revealed wide variations in the types and level of costs and benefits, even for the same type of measure, across different countries.

An analysis of the efficiency of typical measures in agglomerations suggests that the benefits of END implementation in agglomerations significantly outweigh the costs even though the cost-benefit ratios vary substantially between measures.

Conclusion 22: The benefits are likely to be somewhat understated as the analysis only considered the effects of noise reductions on the 'highly annoyed' and 'highly sleep disturbed' populations.

4.2.1.6 European Added Value (EAV)

The END has generated significant EAV by providing a common EU-wide regulatory framework for gathering information and data on environmental noise at receptor underpinned by a "common approach" to noise assessment. There is a clear EAV of the END for EU policy makers responsible for source legislation who need complete and comparable data at EU level to inform the development of new, and the revision of existing noise at source legislation, and to monitor the impact of environmental noise at receptor on health.

The research demonstrated that the END has added value through an EU-level approach in a number of ways, such as through *'volume effects'* (creating a budget for the first time in some EU countries or increasing the budget earmarked to environmental noise mitigation and abatement in national and regional funding programmes), *'scope effects'* (encouraging policy makers across the full spectrum of relevant policy areas such as urban development, infrastructure and transport planning to take greater consideration of environmental noise) and *'role effects'* (through benchmarking, the END has encouraged MS to consider how other MS States are tackling the problem of high levels of environmental noise, with some positive demonstration effects discerned).

In the absence of the END, there would be no harmonised data available for source policy makers to assess noise at receptor and in turn to review limit values in source legislation. In addition, there would be a lack of EU-wide data available on population exposure through which the harmful effects of environmental noise could be quantified. Clearly, the lack of such data would have materially impacted the availability of an evidence base to inform EU noise policy. Moreover, without the END, very few countries would have adopted a more strategic approach to managing environmental noise through an action planning approach.

If the END were to be repealed, then many of the benefits identified to date would be lost. More importantly, the *future* benefits of END implementation from measure implementation and from the collection of gradually more harmonised population exposure data would not materialise. This reflects the fact that the quantifiable benefits of END implementation take significant time (up to 25 years) to fully materialise. Moreover, the effective management of noise is a long-term process and the added value for instance of an action planning approach is only likely to be fully manifested over the longer term.

From a national policy maker perspective, the END has added value by providing opportunities for benchmarking noise mapping and population exposure results at European level, and by increasing the visibility of environmental noise as a serious health issue and strengthening the case for policy makers who compete for scarce public resources domestically to implement measures to reduce noise pollution and/or exposure.

Key conclusion 23: The END has already demonstrated significant European Added Value. Once Commission Directive (EU) 2015/996 is implemented, there is scope for it to add even further value in future, as noise maps and population exposure data becomes more harmonised.

Key conclusion 24: The END has added value to actions some MS were already taking through a combination of 'volume effects' (increased resources for environmental noise), 'scope effects' (greater attention to the problem across a wider range of policy areas) and 'role effects' (promoting benchmarking and the exchange of good practices in noise mitigation).

Key conclusion 25: In the absence of the END, there would be no common approach to noise mapping and action planning, a lack of harmonised data on the level of noise population exposure and longitudinal changes every five years. Source policy makers would also lack data on which to determine limit values in future (once outstanding comparability issues are addressed).

Key conclusion 26: If the END were to be repealed, although some MS would continue to produce noise mapping data and to implement noise mitigation measures, this would not be the case across EU-28. Moreover, the longer-term benefits of the END (e.g. reduced population exposure resulting from measure implementation) would be significantly reduced.

4.3 Future perspectives

Prospective issues relating to how the Directive's relevance, effectiveness and added value might be further strengthened in future are presented in Section 4.3 below.

A number of 'future perspectives' were identified through the research, drawn from a combination of sources, including desk research, an interview programme, oral feedback from the validation workshop and written feedback received on the Working Paper published on the evaluation.

Whilst some suggestions as to how to improve the effectiveness, value added and impact of the END in future were made by stakeholders, others have been made by the evaluation team, drawing on the extensive primary and secondary research carried out.

For each "future perspective" identified through the research, an explanation is then provided as to the rationale and a reminder of the evidence base for these suggestions. Further reference should be made to the relevant sections of the report to gain a full appreciation of the evidence base presented to justify each point. The rationale and evidence base underlying the prospective issues identified that could be addressed in future is now outlined in further detail:

1 - The first objective of the END relating to a "common approach" should be redefined so that this refers not only to 'defining' but also to 'implementing' a common approach.

In relation to the first objective of the END, the legal text of the Directive presently refers in Art. 3 to the need to '**define** a common approach intended to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise". However, whilst the definition of a common approach was evidently a major priority during the first ten years of implementation of the END through the development of CNOSSOS-EU and will continue to be a priority for a further two years in respect of Annex III (assessing the health effects by establishing dose response relationships by source), looking ahead, it is clear that the priority should be not only to define but to actually implement a common approach.

There is presently a lack of compulsion relating to implementation in some areas. For example, the END only requires the development of NAPs, but does not legally oblige the implementation of measures, which are voluntary.

2 - Due consideration should be given as to whether the END should go beyond a "common approach" and set out a more explicit objective as to what the Directive is ultimately trying to achieve (e.g. "protecting human health by reducing population exposure to high levels of environmental noise").

As pointed out in the evaluation of *relevance, coherence* and *effectiveness*, the END lacks an explicit longer-term objective to address public health or the other needs of European citizens and society at large. The END is currently centred on defining a 'common approach' but this is only an intermediate aim.

Although many MS have implemented at least some measures identified in NAPs, the implementation of measures is non-mandatory, and remains at the discretion of MS. In contrast, the Air Quality Directive (2008/50/EC) has established mandatory limits which must be achieved within a specific timeframe.

There are however key differences between air quality and noise, in that the effects of environmental noise exposure are at least partly perception-based (e.g. annoyance).

Nevertheless, if negative health effects are demonstrated through collecting population exposure data and quantifying the harmful effects of noise through revised dose response relationships, , then there is an argument for strengthening the END's objectives.

If a more explicit longer-term objective were set, then a specific target could be introduced relating to the level of noise reduction relative to the baseline situation. There are however different views as to whether such a target should be mandatory or non-mandatory. Setting voluntary targets to reduce the number of exposed persons to environmental noise to achieve a particular percentage reduction by a particular point in time may be a possible compromise.

3 – The implementation of the END could be made more effective in future by recognising the links between tackling environmental noise and other inter-related policy issues.

Noise does not exist in isolation. Many of the sources of noise are considered an essential part of modern society and there are especially close links with issues such as air quality, road safety, transport infrastructure planning (especially the design of new roads), urban and development planning (especially the location and construction of new dwellings). A number of stakeholders mentioned that the END could become more effective there were more of a "joined-up" approach that linked other areas that are relevant to environmental noise. At the level of national implementation, the END might be more effective in future if a holistic approach is adopted by CAs drawing up MAPs and in the identification of appropriate measures that explicitly recognise the links between tackling environmental noise and other relevant areas, such as air quality[175].

4 – The European Added Value of the END could be further enhanced by using population exposure data more extensively to inform the development and revision of noise at source legislation.

The Directive's added value could be further enhanced and serve as a more direct source of inspiration for the revision and development of noise at source Directives if the quality, comparability, utility and completeness of data were to be improved. Whilst comparability issues can only be addressed through CNOSSOS-EU's implementation, the quality of input data and ensuring the full provision of reporting data and information is the responsibility of EU MS, and should be addressed urgently (given that if some countries have access to high-quality input data but others do not, there will be considerable variance in outputs).

5 – The legal text of the END should be subject to a thorough review in future to take into account the various issues identified in this report that would help to improve the clarity of the legal text and to eradicate ambiguities.

A number of issues were raised by stakeholders in relation to the need to ensure that inconsistencies in the Directive are addressed and to bring about greater clarity in the END. This would help to limit the scope for ambiguity in interpreting and implementing the END. This would help to ensure that the legal text is clear, easily comprehensible by CAs and other END stakeholders.

6 - In order to ensure that the definitions and other aspects of the END are better understood by stakeholders, a short accompanying interpretative guidance document could be provided by the EC.

7 – A review of the legal text will need be undertaken at some point in future to ensure that the END is updated to reflect wider EU regulatory developments since its adoption.

It is common to update EU legislation every 10-15 years, depending on the specific directive or regulation. In the case of the END, the Directive needs to be updated with minor wording changes to reflect EU regulatory developments that have taken place since the END came into force in 2002, such as the adoption of the Lisbon Treaty. The changes required ought to be relatively minor (for instance referring to the EU rather than to the Community). There is also a need to ensure that the END makes explicit reference in the recitals to the importance of an open access data policy in the context of ensuring information accessibility to the public and also the importance of open data in

[175] A project was recently undertaken by the EEA and a number of researchers at national level to look into the extent of linkages and possible synergies between Noise Action Plans prepared under the END and the Action Plans prepared under the Air Quality Directive.

the context of the INSPIRE Directive. However, it is for individual MS to determine how they should utilise END data and integrate this with other spatial datasets.

8 – Ensure that the linkages between the END and specific pieces of EU legislation can control the noise emitted by major sources is made more explicit in the Directive. Some END stakeholders appear to be unclear that there are linkages between the END and EU source legislation. Given the mutually reinforcing interrelationship between noise at source legislation and tackling noise at receptor through the END, when the Directive is next updated, it could be helpful to make reference to the most relevant pieces of source legislation either in the recitals or the annexes of the Directive so that the links are more explicitly clear.

9 - The EC should engage further with stakeholders as to whether binding EU, receptor-based noise limit values should be introduced in the END in future.

There was a wide divergence of views as to whether the END should consider introducing source-specific common LVs at EU level in future. There was no support however for having a single common LV across all sources. A less contentious suggestion was that non-binding targets could be set either at an EU or MS level, linked to the prevailing baseline situation in different EU MS, which varies considerably depending on geographic factors, population size, economic development, the state of development of different transport sectors, whether the country concerned is a transport hub, etc.

An alternative approach, which appeared to enjoy some support, was that voluntary targets could be adopted as to the percentage target for the level of noise reduction.

10 - The cumulative nature of noise at receptor from different sources should be measured so as to improve its relevance to citizens and to avoid double counting/over-estimating the benefits of noise reduction measures.

In assessing the health effects of environmental noise, future methodological work could take into account the cumulative nature of noise at receptor from different sources so as to improve its relevance to EU citizens, who are likely to be more interested in their total noise exposure. The END adopts a more technical approach to inform source legislation which seeks to measure noise from each source independently and in isolation. Aggregating data across sources would also help to avoid double counting/over-estimating the benefits of noise reduction measures. However, this would need to be discussed with the MS since it would represent a significant change from current practice.

11 – The efficiency of reporting and monitoring on the implementation of NAPs could be strengthened by ensuring that information is reported in each successive round on which measures have gone ahead in full, in part and those that have not gone ahead at all. Annex V (1) of the END already requires "any noise-reduction measures already in force and any projects in preparation" to be reported. In addition, when the NAP is revised each time it should report on which previous actions have been undertaken or are in preparation. Although some NAPs contain an update as to which measures have been implemented, there is as yet no systematic monitoring and reporting at EU level as to which measures have - and have not been implemented - within each five year cycle.

NAPs could identify the main constraints (e.g. budgetary, other) wherever particular measures could not be implemented, and identify which measures will be continued / discontinued in the next five-yearly action planning cycle and why. Otherwise, the current problem will continue whereby some EU MS include only budgeted measures in their NAPs, whilst others mention a wide range of measures many of which do not appear to have any realistic chance of actually being implemented.

This would help to ensure that better information is available at EU level as to what has been achieved in each successive five year implementation cycle and would provide a stronger evidence base as to the Directive's achievements and the extent of attribution. Both of these are crucial for estimating the END's contribution to reducing high levels of environmental noise.

12 - The information and data provided in NAPs on costs and benefits in the "financial information" section needs to be strengthened, possibly by making further guidance available on estimating measure-level costs and benefits.

In many NAPs, there is either no data or information on either the estimated costs and benefits of proposed measures, or only an estimate of the costs. In other NAPs, data is provided but in aggregate (i.e. covering groups of measures but with no disaggregation of individual measures). Feedback received suggests that many national CAs find it very difficult to estimate the projected benefits of measure implementation in reducing noise.

A clear value added of this study is that through the development of test cases, benchmarks have been established for the costs and the benefits (measured in terms of the magnitude of dB reduction) by type of measure. Reference should be made here to Appendix D (case study methodology and examples of cost-benefit ratios by type of measure), and Appendix F (full set of case studies) which sets out cost-benefit ratios for individual measures developed through this evaluation.

Guidance on how to assess the benefits of measures could be developed by the EC, drawing on the findings and benchmarks presented in this study to assist the MS in estimating costs and benefits. It is also important that in future, MS produce better ex-ante estimates in their NAPs of the costs and benefits, but equally, that greater emphasis is put by national CAs on checking the actual costs and benefits post-implementation of measures (ex-post) so that the two can be better compared.

The 19 test cases relied on ex-ante cost projections provided in NAPs, complemented by data provided by the authorities from the selected cases (where available), expert judgement on benchmarks wherever data was missing or needed an estimate. However, since measures are implemented in different contexts, the cost- benefit ratios are likely to vary significantly by source and by MS.

Improving the availability and reliability of estimated and actual cost-benefit data on measure implementation would be especially useful for the extrapolation of measure-level data to the EU-28 level facilitate future evaluation and cost-benefit assessment work to assess the impact of measure implementation and the contribution of the END to reducing noise at receptor. Currently, the impacts of the Directive require speculative assumptions to be developed for the purposes of extrapolation due to only limited measure-level cost-benefit data being available. If the EC / EEA wishes to have more accurate cost-benefit ratios in future, there will need to be more systematic collection of reporting data on measure implementation under the END reporting systems.

If no data is collected, then cost-benefit estimates at the EU level would have to be undertaken in future using a similar approach to the present study (i.e. be reliant on micro level data collection based on a representative sample of case studies).

13 - In assessing the health effects of environmental noise, future methodological work to assess the benefits needs to take due account of the cumulative nature of noise from different sources so as to avoid double counting/over-estimating the benefits.

Households are affected by noise from multiple sources but END reporting is source-specific, reflecting its important role in informing source legislation for individual transport modes. This is an issue that the EC should consider how to address from a methodological and reporting perspective in future since it will affect the estimates of

the costs and benefits and the health benefits of measures implemented through the END. Since population exposure data is presently collected on a source-specific basis, there is presently some risk of double-counting, although this should be kept in perspective since the research also found that the mostly highly affected exposed population are usually affected most by one source. For instance, people living in a main street in a city are not normally affected by rail or airport noise to the same level of intensity.

14 - Consideration could be given by the EC and the EU MS to strengthening the enforcement of timely reporting on the END's implementation.

a. At EU level, financial penalties could be introduced if Member States do not submit reporting information on SNMs and NAPs by the reporting deadline, or within a specified limit thereafter.

There have been significant delays encountered in the submission of R1 and R2 SNMs and NAPs to the EC in some EU countries. Since this risks undermining the Directive's full and effective implementation (especially the achievement of the second objective of the END (Art. 1(2)) of informing source legislation) due to the absence of timely reporting data and information.

Without timely reporting, the second objective of the END will be much more difficult to achieve (since EU policy makers stated that they were unlikely to use the data without a comprehensive dataset and greater comparability).

The lack of a suitable enforcement mechanism at EU level to oblige MS to submit reporting data and information to meet their obligations under the END in respect of Art. 10 (Collection and publication of data by MS and the EC) was noted in the END. Fulfilling the EC's reporting requirements under Art. 11 has also been made more difficult due to the significant delays that have occurred in both R1 and R2 in the submission of reporting information and data. Consideration could therefore be given by the EC to strengthening the Directive's enforcement.

Although official infringement proceedings could potentially be launched in instances when the reporting information is provided very late (or not provided at all), this was seen by some stakeholders as being too much of a blunt instrument considering the lack of human and financial resources available for implementing the END (and for environmental noise more generally) that remain a problem in some EU countries.

The EU should consider setting proportionate fines in a future revised Directive if MS continue in subsequent rounds to deliver the required reporting deliverables on time since this undermines the effective implementation of the END. In order for population exposure data to be useful to EU policy makers responsible for source legislation, it needs to be available on a timelier basis. The research identified examples of delays in reporting submission of several years. Imposing small fines for such delays in future rounds could providing these were proportionate prompt MS to take earlier action to ensure that SNMs and NAPs are finalised and submitted on time.

This measure should however only be taken in conjunction with other steps to make it easier for national CAs and their local and regional counterparts to meet reporting submission deadlines, such as extending the deadline between the submission of SNMs and NAPs from 12 to 18 months (given that many MS stated that the current 12 months' timeframe caused them difficulties in fitting in an effective public consultation process, analysing the feedback, etc.).

In parallel, further dialogue would be required with MS authorities that have experienced reporting bottlenecks to develop an understanding why delays are occurring. For instance, some EU countries have alluded to budgetary and human resource constraints and others to delays in input data being available for noise mapping.

Others have stated that the END Reporting Mechanism is not user-friendly and it has taken them a long time to submit reporting data and information given limited resources. It will be important to develop an understanding of the specific challenges before launching any enforcement proceedings against particular MS.

b. At national level, the enforcement of national LVs could be further strengthened by EU MS in those MS that have adopted them, including the issue as to what sanctions should be imposed upon exceedence.

It should be noted that the above suggestion to the MS is advisory only, given that the END is implemented under the subsidiarity principle and it is up to individual MS to determine whether to introduce LVs and what sanctions should apply. Nevertheless, the fact that very many END stakeholders pointed to weaknesses in the enforcement of LVs suggests that further action may be needed by MS in this area, otherwise mandatory LVs risk becoming ciphers.

In addition, Steps could also be taken by the MS to review national implementation arrangements including the corresponding national implementing regulations in order to address problems in respect of weak enforcement arrangements at national level to compel local and regional authorities to meet their END reporting obligations on a timelier basis. However, strengthening the implementation rules at national level is the role of national CAs, and formally outside the scope of the END, since under subsidiarity, national authorities are responsible for determining national administrative arrangements and for meeting their END reporting obligations to the EC.

15 - The EEA could assume greater responsibility for checking the quality of data and information presented in NAPs (on behalf of the EC).

Currently, the EEA has been delegated responsibility by the EC to check the quality of SNMs and population exposure data submitted. Although the EEA checks the quality of NAP summaries, subject to resources being made available, it could assume a greater role in checking the quality of data and information presented in the complete version of NAPs. The desk research identified a problem that NAPs are of variable quality.

16 - The efficiency of the END Reporting Mechanism could be strengthened by implementing the various suggestions made in EQ20.

Although the Reportnet, the main reporting tool used for the submission of END reporting information was regarded as being efficient overall, there were various suggestions as to how the tool could be made more user-friendly and how the transmission of reporting information might be simplified. The specific recommendations made are:

- Gaps in END data and information could be more easily identified if Reportnet were to be used as the single END Reporting Mechanism.
- The current requirement in the END for MS' Permanent Representations in Brussels to inform the EC when END reporting requirements have been met should be dropped. This appears to be inefficient and unnecessary, since the data and information ought to be already available in the CDR database (which aggregates data submitted online through the Reportnet). Indeed, an automated email could be set up to alert the EC (and EEA) whenever SNMs and NAPs have been submitted, supported by a courtesy email from the national CA.
- The quality of data collected could be enhanced by eliminating the scope for non-comparability of data in the CDR database between MS, especially in relation to agglomerations (since it is currently unclear for major roads and major railways whether reporting information for these two sources relates to within or inside agglomerations).

- MS should submit reporting data and information electronically via Reportnet, and avoid sending SNMs and NAPs in hard copy, unless this is just a courtesy copy.
- Consideration could be given to allowing MS to submit some reporting information relating to NAP summaries in Word since there are presently a lot of different data fields where information and data has to be re-entered using an online data entry system.
- If MS don't have to manually input the data themselves, this might also prevent them from making data entry mistakes. However, this would require the EC making further resources available for the data entry of reporting information submitted by CAs.
- It should be made clearer what information on the completeness of data in respect of major roads and major railways actually relates to. Presently, it has not been systematically clarified across all MS whether this should include road and railway segments inside or outside of major agglomerations, or both within the same dataset. This impairs data comparability.

With regard to steps that could be taken to address the problem of better managing the problems of delays:

- Reportnet could be customised to provide an **early warning system** for the EC to flag up a situation where MS have missed the formal cut-off dates for the submission of reporting data and information stipulated in the Directive.
- A **written explanation** for the delays from the national CA could be required within a specified timeframe in a future possible revised Directive by the EC.
- A **training session** should be organised for relevant MS authorities by the EC (supported by the EEA) so that national CAs have a better understanding as to how the reporting system works.
- **Extracting data on NAPs** at an aggregate level could be made more user-friendly.
- The number of data fields that MS have to input as part of the **reporting submission process** could be reduced and / or the EC could make some resources available to help to manually input information on NAPs submitted in Word templates to reduce the burden in submitting reporting information for EU MS.

17 - Noise-relevant research results of research projects funded through the EU RTD Framework Programmes and the LIFE programme should be disseminated more widely to increase the uptake of results and strengthen the effectiveness of particular aspects of END implementation (e.g. sharing good practices in respect of quiet areas within agglomerations).

The dissemination of EU research results relevant to END implementation should be further strengthened to support MS in implementing the END. There are a series of interesting projects whose findings could be of practical benefit to competent authorities. For example, there have been a number of projects relating to the development of good practices in the protection of quiet urban areas and preserving the urban soundscape. Since many EU MS have had difficulties in relation to quiet areas, and since only a few have yet designated any quiet areas, it would be useful to share good practices in this area. Reference should also be made to Appendix I which contains a non-exhaustive list of such projects.

The full list of projects identified in table form in the course of this evaluation in Annex I could be disseminated to members of the Noise Regulatory Committee, which could draw it to the attention of other CAs in their MS. The list – or a publication summarising the research results in a project compendium form - could be published on the noise policy website of DG Environment with signposting to the websites of the relevant projects.