Effectiveness evaluation of noise policy in the Netherlands

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ABSTRACT

Noise policy in the Netherlands was formulated in the late 1970s based upon three pillars, which still exist; that is (i) prevention of noise pollution; (ii) solution of existing problems of noise pollution; and (iii) reduction of noise emissions from traffic and other sources. The original policy goal, phrased in the late 1980s, was 'to stabilise the percentage of the noise annoyed population at the level of 1985, i.e. 40%'.
As the WHO recently illustrated, over 40% of the European population is regularly exposed to sound levels from traffic that are considered to have harmful effects. Similar figures are found for the Netherlands, where national surveys illustrated that 40% of the Dutch population were said to be (sometimes) annoyed by noise. The question thus rises whether noise policy in the Netherlands has attained its goals and has been effective in addressing negative health effects due to exposure to noise. Despite various scholars concluding that effective environmental policy requires policy instrument mixes rather than single policy instruments, a generally accepted approach for analysing (the effectiveness of) these instrument mixes is lacking. This paper proposes a methodology based upon academic literature on policy theory, policy instruments, and effectiveness evaluations. And reveals that Dutch noise policy relies heavily on regulative policy instruments which are effective in terms of prevention of noise pollution. However, noise annoyance and other health effects have not significantly been reduced, mainly due to a gaps in noise policy regarding addressing the polluters, that is vehicle use(rs).

INTRODUCTION

Sounds are part of our world. However, compared to the city sounds of the 19th century an enormous increase in sounds and sources is witnessed, and humans are increasingly surrounded by unwanted sounds, i.e. 'noise'. Successive governments in the Netherlands, as in many other Western European countries developed environmental policy during the last four decades, including noise policy. Characteristic for this policy is the legislative, technocratic approach of top-down regulation of polluting sources such as industries, aviation and traffic. Nevertheless, there still appears to have been no breakthrough to fully counter the negative health effects of noise pollution. As the World Health Organisation (WHO 2011) recently illustrated, over 40% of the European population is regularly exposed to sound levels from traffic that are considered to have harmful effects. Similar figures are found for the Netherlands, where national surveys illustrated that 40% of the Dutch population were said to be (sometimes) annoyed by noise (Woudenberg & Van Kamp 2013). Exposure to noise and annoyance can increase stress and blood pressure; known as triggers for cardiovascular diseases (EEA 2010; WHO 2011).

This paper is based upon the PhD research Noise policy: sound policy? which was successfully defended last December 2013, by the author (Weber 2013).

Noise: causes and health effects

Noise is usually classified according to the sources that produce the sounds. The main categories are environmental noise, occupational noise and neighbour noise. The former, which is the topic of this research, is related to noise from road traffic, rail traffic, air traffic, and industrial activities. Environmental noise is associated with a wide range of health effects, such as annoyance, sleep disturbance, elevated hormone levels, physiological stress reactions, cardiovascular disorders, and even premature deaths (Babisch 2013). Annoyance is the most widely acknowledged effect of exposure to noise, and is considered to be the most widespread. Various studies today recommend 50 – 55 $_{LAeq,\ 16hrs}$ as health based threshold, in order to limit annoyance and adverse health effects due to traffic noise (EEA 2010). In addition, the WHO (2009) recently proposed to set a target value for sleep disturbance of 40 L_{night} (outside dwellings) and an interim target of 55 L_{night}, in case the target value cannot be achieved in the short term. These health based limits, though, are far below many regulative limits in European countries; for example the maximum allowed limit for a new dwelling near a municipal road in the Netherlands is 68 L_{den} according to the Noise Abatement Act.

Noise: goals and instruments

Noise policy in the Netherlands was formulated in the late 1970s based upon three pillars, which still exist; that is (i) prevention of noise pollution; (ii) solution of existing problems of noise pollution; and (iii) reduction of noise emissions from traffic and other sources. The original policy goal, phrased in the first National Environmental Policy Plan (1989), was “to stabilise the percentage of the noise annoyed population at the level of 1985, i.e. 40%”; this implied the partial acceptance of the noise problem. This goal was set by the government, as legislator and policymaker a key actor in the Dutch noise policy domain. Noise policy instruments are mainly addressing governmental bodies as physical planner, which mainly concerns regional and local authorities. In order to influence the behaviour of polluters a mix of policy instruments is employed, limiting the negative health effects of noise pollution by reducing noise emissions from sources, noise propagation over certain distances, and immission of noise at dwellings (the so-called noise receivers). The noise policy instruments are typically top-down regulative instruments, whereas economic and communicative instruments, using the typology of Vedung (1998), are hardly employed.

Analysing and evaluating noise policy in the Netherlands

Noise pollution is an old environmental problem, which still has not been resolved despite having Dutch and international noise policy in place for many decades. Nevertheless, today’s policy instruments have hardly been adjusted or revised, except for a few experiments on environmental policy integration. Noise policy in the Netherlands was and still is typically a ‘centralised governance mode’.

The PhD research aimed at analysing and evaluating the noise policy domain in the Netherlands, by answering, in a meta analysis, questions on stability or dynamics within the policy domain, the (f)actors explaining stability and/or change in noise policy subsystems, and the policy outcomes achieved. The latter, the effectiveness evaluation of the noise policy instrument mixes, is further discussed in this paper.

In order to assess whether the presumed limited dynamics affected the performance of the noise policy domain, the outcomes of Dutch noise policy have been evaluated. A stepwise approach was developed in order to be able to evaluate policy instrument mixes, based upon, amongst others, Hoogerwerf's policy theory (1990) and Mickwitz's effectiveness evaluations (2003). The empirical data analysis consisted of document reviews and interviews, in order to (i) provide a historical overview of (changes in) legislation and policy goals; (ii) identification of policy instruments, actors addressed by these instruments and the expected outcomes, (iii) providing data on the status quo of noise pollution.

EFFECTIVENESS OF NOISE POLICY INSTRUMENTS MIXES

Despite various scholars concluding that effective environmental policy requires policy instrument mixes rather than single policy instruments, a generally accepted approach for analysing these instrument mixes is lacking (Glasbergen 1992; Taylor et al. 2012). The PhD thesis thus proposed a methodology based upon existing scholarly approaches, such as Hoogerwerf's policy theory (1990), Vedung's typology of policy instruments (1998) and Mickwitz's effectiveness evaluation model (2003).

Policy (processes) can be evaluated against its output, its outcome and its impact. Outputs are defined as tangible results of a policy, such as programmes or plans. The outcome of policy, according to Gysen et al. (2006) is the response of target groups to the output. Finally, impacts are related to physical changes in the state of the environment, such as reduced levels of noise exposure.
In this research an ex-post evaluation of the effectiveness of Dutch noise policy was conducted, based upon the goal-achievement model (e.g. Scriven 1991; Van Gossum et al. 2012). The challenge in analysing the effectiveness of policy instruments *mixes* lies in the relation between the single instruments and the overall outcome(s) achieved. In the case of noise policy different goals are defined; often without any explicit linkage in outcome or impact, in time or in target addressees. As a consequence, simply summing up the effects and effectiveness of individual policy instruments will not suffice. Second, several policy instruments can either mutually reinforce or counteract on points of interventions in the cause-effect chain.

Analysing effectiveness: a stepwise approach

Lacking a generally, academically accepted approach for effectiveness evaluation of policy instrument mixes, a stepwise approach has been developed, comprising

(i) description of the noise policy theory in terms of causes and effects, and the points of application for policy instruments;
(ii) description of policy instruments in place;
(iii) analysis of goal attainment and measured effects; and
(iv) attribution of the relative contribution of individual policy instruments to the level of goal attainment and the combined effects of policy instrument mixes. The latter step focused on the coverage of points of intervention, steering power of policy instruments and coherence of policy instruments mixes.

Describing Dutch noise policy instrumentation

The first step, reconstructing the policy theory, provides insight into the main points of application. That is, the actors or targets that are addressed by policy instruments in order to change their behaviour in a sustainable way. Following, the various types of policy instruments are described and categorised according to the main typologies as defined by Vedung (1998) and linked to the policy goals. Presenting points of application, policy instruments, effects and goals in a 'flow chart' or 'mindmap', provides a clear 'picture' of the policy instrumentation (see for example Figure 1). The coverage of the policy instruments is highly illustrative and relevant for the subsequent steps.

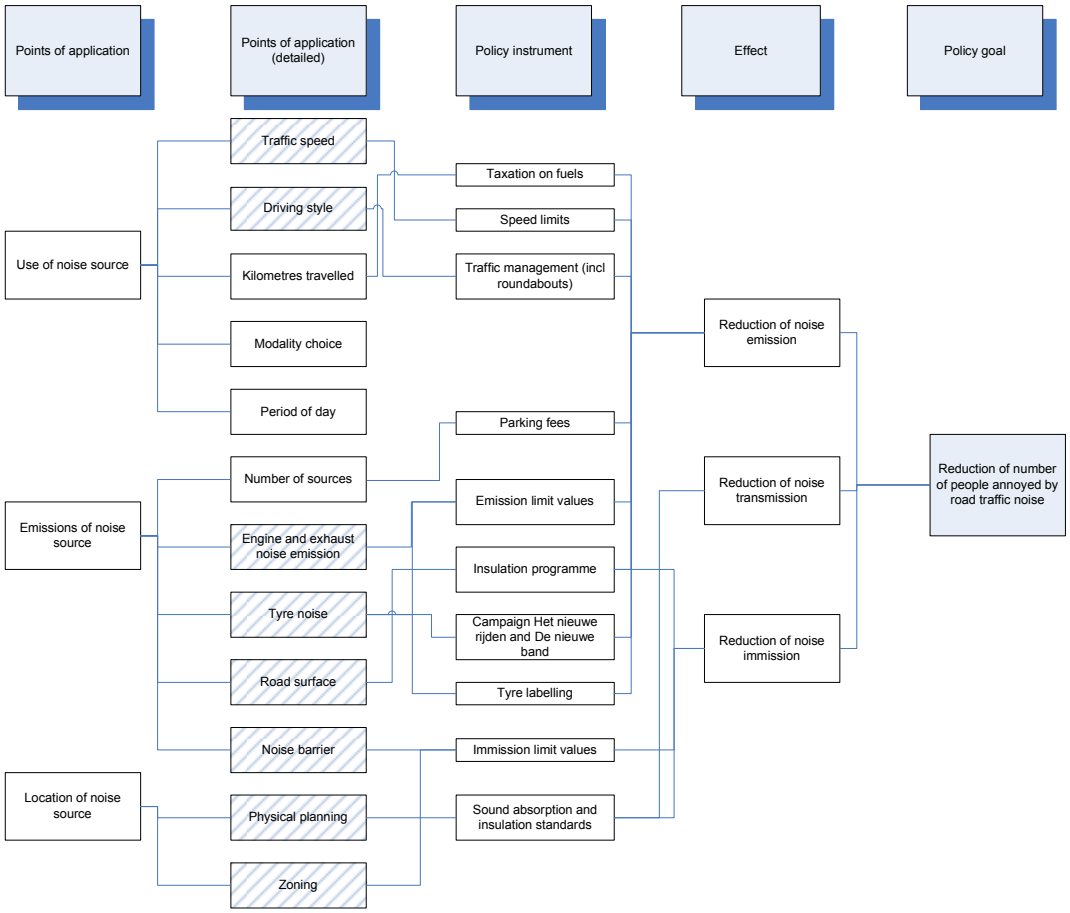

Figure 1: coverage of points of application (source: Weber 2013)

In Figure 1 the coverage of points of application is presented, indicating by coloured, striped boxes the targets addressed through policy instruments. The targets, such as activities or actors, that are missed by today's noise policy instruments are left blank.

Intermezzo: Dutch noise policy instruments

In this section a short description of today's main noise policy instruments is provided; a comprehensive overview is provided in the PhD thesis.

Noise *emissions* are the result of several source specificities, such as the number, place and time of vehicles that are used and the technical standards of the vehicles. Vehicle and tyre noise emissions are internationally regulated, though the main aim of these directives is to harmonise product requirements and markets in Europe. Pricing of parking, fuel taxation, restricted (city centre) zones and road pricing are examples of economic policy instruments, though the latter two instrument are not in place in the Netherlands due to political and societal discussions. Finally, vehicle use is addressed through traffic speed regulation and traffic management; both regulative instruments. Noise *transmissions* are limited through the Noise Abatement Act requiring competent authorities planning to (re)construct a road or a residential area to comply with regulative noise limits. Frequently technical measures are implemented such as low noise road surface and noise barriers. *Immission* standards are defined in the Noise Abatement Act, varying for existing or new situations, for the location of the dwelling (urbanised area or non-built area) and for noise sources (e.g. road traffic, railway traffic). In case the façade exposure is too high dwellings are insulated through a nationally financed programme aiming at improving the acoustic quality within dwellings.

Analysing goal attainment

In the effectiveness evaluation the policy goals that have been formally set in laws and policy plans are taken as reference.

Table 1: policy goal achievement (source: Weber 2013)

Policy goal ***[Source, document]***	**Outcomes realised (appr. situation 2010)**	**Goal attainment**
Prevent and solve noise problems and guarantee good acoustic quality	2.5 mio of a total of 7 mio dwellings have noise levels above regulative preferred noise level (48 dB) due to traffic noise. Acoustic quality of 2.5 mio dwellings varies between 'moderate' (48-53 dB) to 'extremely negative' (more than 68 dB). Appr. 1,1 mio dwellings have noise levels above 60 dB due to traffic noise.	+/-
Percentage of noise annoyed persons is stabilised in 2000 at the level of the percentage of noise annoyed persons in 1985 (i.e. 40%) and the number of persons being highly annoyed is to reach 0%	Appr. 30% of the Dutch (adult) population is annoyed due to road traffic noise, based upon surveys (CBS; RIVM/TNO, PBL).	+
Maximum noise levels of 70 dB are not exceeded in 2010.	Appr. 46.400 persons live in dwellings with noise levels higher than 70 dB (according to noise maps END). This approximates 1 % of the Dutch population.	-
All dwellings with noise levels above 55 dB (i.e. in the year 1986) will be insulated by 2010.	By the end of 2008 appr. 180.000 dwellings are insulated and still 530.000 dwellings have noise levels above 60 dB (based upon situation 1986 and the adjusted threshold for insulation), of which appr. 245.00 have noise levels above 65 dB.	-
Noise emissions from road traffic will be reduced with 2 dB in 2010; and long term goal is reduction of noise emissions from road traffic of 6-8 dB.	Noise monitoring along highways proves no reduction of noise emissions from road traffic has been achieved (RIVM 2008). Rather recent measurements proved road traffic noise being appr. 2 dB higher than assumed in noise calculation models	-

One of the challenges in the effectiveness evaluation of Dutch noise policy is that several policy goals during the last three decades have been shifted or adjusted. Therefore I mainly focused on the trends in the variable 'percentage of noise annoyance' in line with the original goal of noise policy. In addition, sub policy goals regarding noise immission levels on façades of dwellings and the noise emission levels from traffic were taken into the evaluation as well. Table 1 presents the various policy goals, the outcomes realised and an overall valuation of goal attainment (positive, neutral, negative scores). In sum, the main policy goal of preventing noise pollution and stabilizing the percentage of noise annoyed population has been attained. The sub-policy goals, regarding insulation of dwellings with too high noise exposure and reduction of noise emissions from vehicles, have still not been met.

Though not addressed in the PhD thesis, some words on *cost*-effectiveness are relevant as well, reflecting on the budgets spent in relation to the outcomes achieved. This paragraph though to be regarded as some preliminary notions based upon rough, aggregated and mainly national government level data. Noise policy has been formulated and implemented in the Netherlands at the end of the 1970s and 1980s. Costs required for the insulation programme were estimated as follows (programme of 10 years): dwellings exposed to (mainly) road traffic noise appr. 568 million euro, and dwellings exposed to (mainly) railway traffic noise appr. 45 million euro. Rough calculations learn that since then around 2,9 billion euros have been spent by the national government on reduction of traffic noise exposure. These budgets were mainly spent on façade insulations, around 500 km noise barriers along and low noise pavement of national high ways. Costs for noise barriers along railways, around 110 km length, are estimated at 500 million euros since early 1980s.

Evaluation of effectiveness

The final step in the effectiveness analysis approach focuses on the expected and the perceived effectiveness based upon literature reviews and expert interviews respectively. From Figure 1 it becomes clear that some targets are weakly or not addressed by single or combinations of policy instruments. An example is the use of cars; in the Netherlands traffic volume policy is highly disputed as politicians hesitate in addressing 'the holy cow'.

Regarding the steering power of policy instruments some interesting observations are the low impact of international regulations of vehicle noise and of the mainly economic and communication instruments addressing the transport sector. On the other hand, regulative instruments targeting government bodies by setting noise limits for physical planning, and the economic instrument for façade insulations, seem rather powerful and, consequently, effective. Finally, regarding coherence of the policy instrument mix some effective combinations are found in the Dutch noise policy domain, such as the regulative (i.e. Noise Abatement Act) and economic (national funding) instruments for façade insulations. The *perceived* effectiveness is analysed through experts' judgments, rejecting or confirming the earlier findings on expected effectiveness based upon desk study. In Table 2 the perceived effectiveness of the various policy instruments for the specific points of application and addressees is summarised in terms of reduction of noise pollution.

The scores range from not effective at all (- -) to very effective (+ +); if a policy instrument has not been implemented yet or expert opinions vary (0) is applied.

Table 2: perceived effectiveness (experts) (source: Weber 2013)

Point of application and policy instrument	**Actors influenced**	**Perceived estimated effectiveness in terms of reduction of noise pollution**
Noise source (emission)		
Distribution over time and place of noise sources		
Zoning (spatial planning)	Local administration	+
Restricted zones	Transport sector Individuals (car drivers)	0 (not implemented)
Parking fees	Transport sector Individuals (car drivers)	0 (average of expert opinions)
Technique of noise source		
Emission limit values	Automotive industry	+ (heavy vehicles) - (passenger cars)
Campaign 'De Nieuwe Band (The New Tyre)'	Transport sector Individuals (car drivers)	-
Volumes of noise sources		
Road pricing/charging	Transport sector Individuals (car drivers)	0 (average of expert opinions)
Taxation on fuels	Transport sector Individuals (car drivers)	-
Use of noise source		
Speed limits	Transport sector Individuals (car drivers)	0 (average of expert opinions)
Traffic management (e.g. traffic calming)	Transport sector Individuals (car drivers)	+
Campaign 'Het nieuwe rijden'	Transport sector Individuals (car drivers)	-
Noise transmission		
Technical requirements i.e. noise barriers	Road authorities (national, regional and local)	++ Note: not policy instrument in definition as applied in research
Technical requirements i.e. low noise road pavement	Road authorities (national, regional and local)	++ Note: not policy instrument in definition as applied in research
Noise receiver (immission)		
Immission limit values	Local administration	+
Sound absorption and insulation standards	Local administration and project developers	+
Insulation programme (ISV)	Local administration	+

CONCLUSIONS AND RECOMMENDATIONS

The above reveals that although the main policy goal of stabilising the percentage of annoyance has been attained, sub policy goals have not been achieved. Furthermore, from a health perspective, noise policy has not been able to substantially reduce the negative health effects associated with noise pollution.

This trend seems to be in contrast to other environmental health domains where improvements have been achieved during the last decades. The resulting limited effectiveness of today's noise policy instrument mixes is explained by the high reliance on regulative policy instruments, and a lack of mutual policy goals at national and decentralised administrative levels. 'Sound' policy has to improve effectiveness of the policy instrument mix by addressing car use(rs), which currently are not aware of the negative effects of their behaviour nor addressed according to the 'polluter-pays-principle'.

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