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**PUBLIC ROAD SAFETY
POLICY CHANGE AND
ITS IMPLEMENTATION –
VISION ZERO A ROAD
SAFETY POLICY
INNOVATION**

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ABSTRACT

It has been estimated that, worldwide, the number of people killed in road traffic crashes each year is almost 1.2 million, while the number of injured could be as high as 50 million. Although road traffic injuries make up a very complex area, comprehensive knowledge of the magnitude of the road safety problem and important risk factors, and also theoretical and practical experiences of effective road safety strategies and measures, have been developed over the years. However, we still lack systematic knowledge about the way governments in different time periods have tried to tackle this major public health problem.

Aims: The overall aim of this thesis is to increase knowledge of road traffic safety public policies and their implementation. This is achieved by exploring Vision Zero as a safety policy of this kind. The policy was adopted by the Swedish parliament in October 1997.

Methods: The thesis comprises four studies, based on a policy analysis approach, where studies I and II focus on policy, and III and IV on policy implementation. For all four studies, a case study method was utilized, including both single and multiple case studies. For all the studies, documents produced by governmental bodies were utilized as the main source of information, and the contents of these documents were analyzed. For studies I and IV, a policy theory approach was adopted in order to analyze the ideas underpinning Vision Zero as a public policy, and safety cameras as a road safety policy instrument. For studies II and III, an evaluation approach was adopted.

Findings: In **study I** it is shown that Vision Zero is a politically adopted road safety public policy with broad political support. Vision Zero as a road safety policy does not only present a long-term goal, but also represents an innovative and radical approach to the promotion of an alternative framework. According to **study II**, politically adopted road safety goals, embodied in general and quantified time-bounded targets, are policy strategies that have evolved since the beginning of the 1970s in Sweden. Three adopted road safety targets were identified, and all were specific, measurable, time-bounded, and at least theoretically achievable. However, it seems that the targets adopted in 1996 and 1998 were, compared with the general historical trend, more or less unrealistic. According to **study III**, Vision Zero exhibits a fundamentally new approach to the allocation of responsibilities for the prevention of traffic injuries. The responsibility for road safety should be shared between road users and system designers, according to the principle that the system designers should always have ultimate responsibility. Thus, Vision Zero as a public policy envisages a chain of responsibility that both begins and ends with the system designers. According to **study III**, this principle of responsibility has only been minimally implemented in formal legislation. Although the principle of responsibility has not been fully implemented, there is an on-going implementation process through which other less intrusive policy instruments have been pursued.

In **study IV**, it is shown that even though the speed camera system in Victoria, Australia and the Swedish system technically have the same aim – to reduce speeding – ideas on how that should be achieved differ substantially. The Swedish approach to safety cameras appears to be based on the beliefs that road safety is an important priority for road users, and that one of the reasons why road users drive too fast is a lack of information and social support. Accordingly, the underlying aim of the intervention is to support and create a new social norm among drivers, namely that it is easier and better to follow the speed limits.

Conclusion: Vision Zero is a politically adopted policy, which is founded in the clear ethical stance that everyone has the right to use roads and streets without threats to life or health. The adoption of difficult or even unrealistic quantified targets may serve as a management tool, and inspire stakeholders to do more than they would otherwise have done. Setting time-bounded quantified targets is, therefore, a policy action in itself, aimed at motivating different stakeholders. The underlying rationale is not directly to achieve the goals and the targets per se, but to increase public awareness of the road safety problem, and thereby impose pressure on stakeholders to strengthen their efforts.

Although, according to Vision Zero, system designers have the ultimate responsibility for safety, this principle of responsibility has been only minimally implemented in formal legislation.

There are major differences between the ideas underlying the speed camera programs in Victoria, Australia and Sweden, and these ideas have an impact on the actual design of the different systems, and how they are intended to have road safety effects.

Key words: Vision Zero, public policy, public policy implementation, policy analysis, policy instruments, case study, policy theory, road safety

LIST OF PUBLICATIONS

- I. Belin, M-Å., Tillgren, P., Vedung, E. (2011). Vision Zero – a road safety policy innovation. *International Journal of Injury Control and Safety Promotion*, Available online: 14 Dec 2011.
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- III. Belin, M-Å., Tillgren, P. A step in the realization of Vision Zero – a process evaluation of the implementation of formal safety responsibility for system designers (submitted).
- IV. Belin, M-Å., Tillgren, P., Vedung, E., Cameron, M., Tingvall, C. (2010) Speed cameras in Sweden and Victoria, Australia – a case study. *Accident, Analysis and Prevention*. Vol. 42:6 pp. 2165-2170.

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LIST OF ABBREVIATIONS AND GLOSSARY

IRTAD	International Road Traffic and Accident Database, part of OECD
ITF	International Transport Forum, part of OECD
OECD	Organization for Economic Co-operation and Development
WHO	World Health Organization
SMART targets	Specific, Measurable, Achievable, Realistic, Time-bounded
Case study	An empirical inquiry that investigates a contemporary phenomenon within its real-life context, when the boundaries between phenomenon and context are not clearly evident
Evaluation	Careful retrospective assessment of the content, implementation, output and outcome of a public policy, with a view to it being used
Ideal type	A 'pure type', constructed by emphasizing logical or consistent traits of a given social item. The traits are defining ones, not necessarily desirable ones. Ideal types do not exist anywhere in reality; rather they are 'measures' that we can use in comparing social phenomena
Implementation	The act of carrying out or accomplishing a policy; also the state of been carried out (accomplished or the state of being executed)
Incrementalism	A policy or advocacy of a policy for political or social change by degrees
Policy adoption	A political process where policies are formally adopted
Policy analysis	An analysis that produces knowledge of and in policy processes
Policy instrument	The set of techniques by which governmental authorities use their power when attempting to ensure support and effect social change
Policy making	A political process where policies are designed and formulated
Policy theory	All empirical and normative suppositions that public policies rest upon; also referred to as program theory, governance theory, or intervention theory
Road safety	Overall safety of the road transport system, consisting of the road infrastructure, the road environment, the vehicles and the road users
System designers	The public and private agencies responsible for the design and operation of various parts of the road transport system, such as roads, vehicles and transport services, and those responsible for various support systems for safe road traffic, such as regulations, education, information, surveillance, rescue, care and rehabilitation
Vision Zero	The goal is that no-one shall be killed or seriously injured as a consequence of accidents in road traffic; the design and function of the road transport system shall be adapted to meet this goal

1 ROAD TRAFFIC INJURIES: A MAJOR PUBLIC HEALTH AND DEVELOPMENT PROBLEM

It has been estimated that, worldwide, the number of people killed in road traffic crashes each year is almost 1.2 million, while the number of injured could be as high as 50 million. Without increased efforts and new initiatives, the total number of road traffic deaths and injuries is projected to rise by 65% between 2000 and 2020, and in low-income and middle-income countries deaths are expected to increase by as much as 80% (Peden *et al.*, 2004).

According to the Global Status Report on road safety, road traffic injury was the ninth leading cause of death in 2004, and it has been estimated that, if current trends continue, road traffic injuries will become the fifth cause of death by 2030 (WHO, 2009). Globally, road traffic injuries are without any doubt a major public health problem. However, there is considerable regional variation. The high-income countries in Europe have the lowest road traffic fatality rate, followed by countries in the WHO Western Pacific Region (Peden *et al.*, 2004).

Sweden, the Netherlands and the United Kingdom, compared with other highly motorized countries, had one of the lowest fatality rates per 100,000 inhabitants in 2009 (IRTAD, 2011). After World War II the number of cars started to increase rapidly in Sweden (Tengström, 1991), and the number of fatalities increased, according to official statistics, from 8.4 killed/100,000 inhabitants in 1950, to its highest level, of 17 killed/100,000 inhabitants, in 1965. Beginning in 1970, Sweden has faced a long-term trend where the number of fatalities has decreased. According to official statistics for 2010, there were 2.8 killed/100,000 inhabitants (Trafikanalys, 2011).

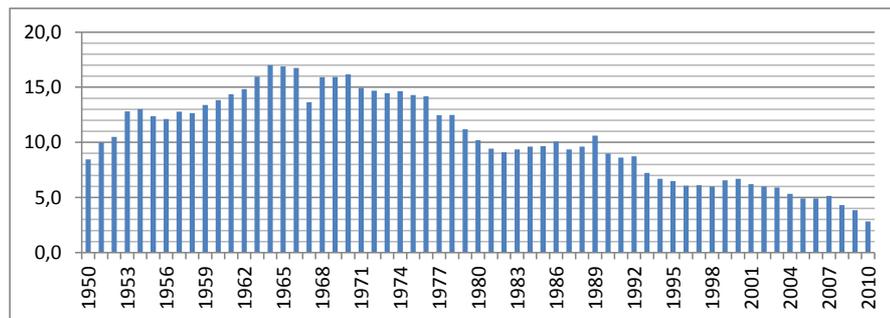


Figure 1. Number of persons killed in road traffic collisions/100,000 inhabitants in Sweden 1950–2010.

When the number of fatalities and injuries started to grow after World War II, the problem was detected by medical doctors around the world. Children and their vulnerability were paid especially great attention, and injuries and injury prevention became important sub-fields of expertise in Social Medicine (Smedby, 2010; Jansson, 2011). Knowledge was transferred into both local and national policy processes in order to influence decision makers, at various levels in society, to take action in a systematically evidence-based way. For example, a joint committee on childhood safety was established in Sweden as early as in 1954 (Jansson *et al.*, 2006), and the early 1970s saw the development of the concept of a Safe Community, which has spread all over the world (Svanström, 2011).

Sweden also has a long tradition of considering road traffic injuries as a public problem that needs to be addressed by the national government. This attitude culminated when the Swedish parliament in October 1997 adopted Vision Zero as a new long-term goal and direction in road traffic safety work:

“The goal is that no-one shall be killed or seriously injured as a consequence of accidents in road traffic. The design and function of the road transport system shall be adapted to meet the requirements that follow from Vision Zero” (Swedish Government and Committee on Transport and Communications, 1997).

Although road traffic injuries make up a very complex area, comprehensive knowledge about the magnitude of the road safety problem and important risk factors, and also theoretical and practical experiences of effective road safety strategies and measures, have been developed over the years (Elvik and Vaa, 2004; Peden *et al.*, 2004). However, we still lack systematic knowledge about the way governments in different time periods try to tackle this major public health problem. There is inadequate understanding and interpretation of the dynamics of the processes aimed at formulating, adopting and implementing road safety policies, and how sound road safety interventions are spread in society (Wegman and Hagenzieker, 2010).

Improving road safety requires knowledge of policy making and implementation processes, of measures known to be effective, and of how and where, in other sectors of society, road safety aspects can be mainstreamed and partnerships built. It also requires the ability to choose the strategies and approaches that best fit the specific conditions of different countries (Racioppi, 2004). Hopefully, this thesis can, at least partially, fill this gap by generating information on road safety policy and the role of the government in Sweden, which might be regarded as a leading example of success in road safety worldwide.

2 PUBLIC POLICY AND ROAD SAFETY

The development of public policies must be placed in the context of the movement to rationalize public policy making (Parsons, 1995), and also the desire to transform public policy into a more rational, even scientific, enterprise (Dunn, 1994; Vedung, 1997). The combination of research-like analysis and extensive programs marks the breakthrough of what was called the Great Society in USA and the Strong Society in Sweden (Vedung, 1997). The problem of road traffic injuries and the societal efforts to combat this major problem have definitely been influenced by this movement.

2.1 THEORIES AND MODELS OF POLICY MAKING AND POLICY IMPLEMENTATION

2.1.1 Public policy problem – in the eye of the beholder

The problem of definition has been considered as the most crucial stage in policy processes (Dery, 1984). Some people believe that policy problems are objective conditions whose existence may be established simply by determining what the facts are in a given case (Dunn, 1994). Yet, problems are not objective entities only (Dery, 1984).

To define a problem is to choose what goals or values to aim at, what values to sacrifice, what counts as a solution, and what kinds of means to consider. The same policy-relevant information can, and often does, result in conflicting definitions and explanations of a problem. This is not so much because the facts of the matter are inconsistent (and often they are), but because policy analysts, policy makers, and other stakeholders make competing assumptions about human nature, government, and opportunities for social change through public action (Dunn, 1994). Road traffic injuries as a public health problem are not an exception. Thus, the problems are in the eye of the beholder.

2.1.2 Public policy and implementation

The term public policy is used in many different ways, and it is not a precise or self-evident term. For example, it may be an expression of a specific area of interest, a general view, a concrete action, a decision by the government, a formal mandate, a specific proposal, a program, a performance, an effect, a theory, a model or a process (Hogwood and Gunn, 1984). What is, in general, striking about the definitions of public policy indicated here is the purposive character public policies are expected to have, and also the way in which they are expected to be related to societal problems (Hill and Hupe, 2002).

Several scholars stress that, although public policy involves the institutionalized intention to act on some particular problem, its definition should also include its implementation and administration (Walt, 1994; Parsons, 1995; Anderson, 2000). This thesis does not adhere to this very broad definition of policy. Instead, it makes a clear distinction between an adopted policy and its implementation, between intentions and actions to achieve what is intended.

The attempt to study implementation raises the most basic question about the relation between thought and action: How can ideas manifest themselves in a world of behavior? According to Pressman and Wildavsky (1984, Page xxi) “. . . a verb like ‘implement’ must have an object like ‘policy’.” But policies normally contain both goals and the means for achieving them. How then, do we distinguish between a policy and its implementation?

Lane’s (1983) suggested solution to this dilemma is to make a clear distinction between the two dimensions of an implementation phenomenon: the intentional dimension, and the behavioral dimension. Therefore, a policy is different from its implementation. The policy comes before the implementation, and the implementation may be studied or evaluated afterwards, in terms of the policy as it proceeds and actual activities. The lesson to be learned from this, according to Lane, is that when considering any reform or major political decision, it is essential to differentiate between the stated intention and what has actually been put into practice. It is one thing to derive articulate ideas on means-end chains from governmental policy sources, but quite a different thing to pin down what actual means were employed and their actual effects. A road safety policy is therefore a future-oriented phenomenon that includes ideas about both what should be done and how to get there.

2.1.3 Public policy making

There are several complementary and conflicting theories and models that have been constructed in order to develop, explore, explain and evaluate public policies. There are a handful of comprehensive reviews (Stone, 1988; Parsons, 1995; Sabatier, 1999). However, in this thesis, inspired by Stone (1988) and Walt (1994), the rational-comprehensive and what we might call the community model will be discussed in greater depth.

In the road safety sector, the rational-comprehensive model seems to be the dominating paradigm (Swedish National Road Safety Council, 1989; OECD, 1994; OECD, 2002; Elvik and Vaa, 2004). This model is based on the idea that a policy making process can be seen largely as a problem solving process. In the model, the process is described on the basis of a few different logical steps. The model is also based on several assumptions, and goes hand in hand with the movement towards basing policy decisions on scientific evidence. There is a tendency to describe processes in society in a linear and planned way, where there is a consensus about problems and objectives, and the decision about policy instruments is only a matter of choosing the most cost-effective ones. In cases where you need to achieve different objectives, you can always find an optimal balance between these different requirements.

Further, this model is based on the assumptions that humans have a high degree of capacity to process information, rank preferences, and attain objectives. The model puts great trust in human beings, and on their capabilities to solve social problems with the help of scientific knowledge. It is also very much based on the assumption that there is a great degree of consensus in the whole society. Policy change, according to this model, is mainly a result of feedback from evaluations that have been carried out in a systematic and scientific way (Parsons, 1995).

However, there are competing approaches, which are more political by nature. These theories and models (Lindblom, 1959; Lindblom, 1979; Stone, 1988; Sabatier and Jenkins-Smith, 1993; Baumgartner and Jones, 2002) are based on the assumption that a policy process, to a great extent, is a matter of a political game where different groups and individuals in society try to pursue their different interests. There is no such thing as a single common problem. To the contrary, you have a lot of different problems and different views on what is worth achieving in a society. The society is much more complex, and there is no such thing as a best solution. It is more a matter of finding support for doing at least something, and the process is to a great extent one of communication (Rogers, 1983). Diffusion of ideas and interventions is important, and the process is to a great extent based on a copycat behavior rather than a comprehensive analysis. What works in one place might also work in another setting. In this model, there is less of a belief in human capacity to process information and to solve social problems (Simon, 1976). Institutions, therefore, play an important role in narrowing the range of possible solutions to a certain problem (Ostrom, 1998; North, 1990). Usually, the policy making process is incremental (Lindblom, 1979), and there is a need for a long-term perspective, but sometimes changes are very quick and chaotic (Baumgartner and Jones, 2002; Kingdon, 2003). Policy change can therefore mainly be seen in terms of long-term learning and adaptation (Sabatier and Jenkins-Smith, 1993; Parsons, 1995).

2.1.4 Public policy implementation

Based on the rational-comprehensive model, the implementation phase has often been seen as a quite uncomplicated process divided into the following three steps: an agent to carry out the policy is chosen by the policy maker according to technical criteria; the policy is communicated to the agent through instructions; and, finally, the implementers carry out the specific instructions according to the policy guidelines (Nakamura and Smallwood, 1980). This view of implementation fits very well into the 'classical' hierarchical model of public administration, where the decisions that are involved in the implementation of policies are non-political and technical by nature. It is the responsibility of the implementer to carry out policies in a neutral, objective, rational and scientific way (Nakamura and Smallwood, 1980). In the literature, this model is called the top-down model (Hill and Hupe, 2002).

Sabatier and Mazmanian (1979) have identified five conditions for effective implementation according to the top-down model. These are: a program is based on a sound theory; the basic policy decision contains unambiguous directives and a well-defined implementation structure; the leaders of the implementing agencies possess substantial managerial and political skill and are committed; the program is actively supported by different stakeholders through the implementation process; and, finally, the relative priority of statutory objectives is not significantly undermined by external factors.

However, to go from policy intentions to sound policy outcomes in a complex world is difficult, as experiences of evaluation and implementation research have shown (Sabatier and Mazmanian, 1979; Vedung, 1997). Therefore, since the 1970s, a number of studies have been carried out in an attempt to pin down what has been called the missing link in policy research (Nakamura and Smallwood, 1980; Hill and Hupe, 2002). This research has contributed to a skeptical perspective on the opportunities to get policy intentions implemented in society, and it has even been portrayed as the 'misery research' of the social sciences (Rothstein, 1998). Implementation of road safety interventions is no exception. For example, according to Elvik (2010), studies of actual priorities in road safety policy, in particular in the Scandinavian countries, suggest that these priorities are inefficient.

However, according to Rothstein, (1998) implementation research might be too negative with regard to the government's ability to implement policy. One reason for this negative assessment is that research has taken an excessively mechanistic and rationalistic view on the process of implementation instead of adopting an approach more based on community learning. There might also be a time complication if the researcher has too narrow a span – from intention, through implementation, to an achieved outcome in society.

Lipsky's analysis (Lipsky, 1980) of the behavior of so-called street-level bureaucrats is a classic study that challenges the common top-down model. According to Lipsky, decisions made by the street-level bureaucrats, and the routines they establish to cope with uncertainties, became de facto the public policies. Hjern, together with Hull (Hjern and Hull, 1982), has also argued that the implementation of activities is carried out in different networks, and therefore the traditional hierarchy model is not particularly appropriate, nor even preferable, for the understanding of implementation. Therefore, networks of organizations and policies that are developed in the implementation process and from a consumer-driven perspective are aspects of what has been called the bottom-up approach to implementation, which is more in line with the community model.

2.1.5 Public policy instruments

Public policy instruments are the set of techniques via which governmental authorities use their power when attempting to ensure support and effect social change (Bemelmans-Videc *et al.*, 1998). The choice of instruments will reflect more general political and administrative strategies. If we believe that the rational-comprehensive model reflects the real world, the choice of policy instrument is a quite straightforward matter; that is, you choose the alternative that best satisfies your preferred outcome (Dunn, 1994). Cost-benefit analysis has been used, for many years, to set priorities for road safety measures and, according to Elvik and Vaa (2004), its application goes back at least twenty-five years.

The OECD recommends that consideration should be given to reviewing the cost effectiveness of road safety measures with a view to producing clear guidance on the state of the art in methods of evaluation, and on the measures likely to have the best benefit-cost ratios. According to the OECD, it is imperative that attention should be paid to obtaining best value for money by targeting activities where they will be most cost-effective (OECD, 2002).

However, with a broader perspective on policy making and implementation, the design and choice of policy instruments are much more complicated. The process will vary with the background roles and cognitive orientations of policy makers, and also with the contextual factors that have historically influenced their views on the instruments that are embedded in the implementation structure (Bemelmans-Videc *et al.*, 1998).

According to Vedung (Vedung, 1997), there are only three basic kinds of instruments to which governments have access. These are regulation, economic instruments and information, in other words, the stick, the carrot and the sermon. Governments can force, reward or charge the target group materially for doing something, or preach to the target group that they should do something. Policy instruments usually come in vertical, horizontal or chronological packages, rather than in isolation. In order to reduce the number of fatalities and injuries in road traffic and to maintain already achieved reductions, the government has a myriad of different strategies, policy instruments and public organizations at its disposal, which are intended to influence both collective actors and individuals.

In the road safety sector, an example of a vertical package might be when the Swedish government, through legislation, gives authority to the Swedish transport administration to subsidize local municipalities' investments in road safety.

An example of a horizontal package might be when the police, together with other stakeholders, carry out regulatory enforcement and provide information, at the same time, in order to prevent drink-driving.

Finally, an example of the chronological sequencing of policy instruments might be the efforts to make people use front-seat belts in vehicles (see figure 2 below). According to Andréasson and Bäckström (Andréasson and Bäckström, 2000), a major step in the introduction of seat belts into Swedish society was part of the industrial safety plan initiated in the early 1950s by the State Power Board (Vattenfall). In 1969, legislation was passed requiring all cars to be equipped with seat belts. In 1971, the Swedish Traffic Safety Office launched a major seat belt campaign, and seat belt use went up from 20% in 1971 (Swedish Road Safety Office, 1972) to 50% prior to the 1975 law that made it mandatory to use seat belts. Frequency of use then increased to up to 85% (Campbell and Campbell, 1986).

Since 2002, the consumer crash protection program in Europe, Euro NCAP, has rewarded cars with seat belt reminders. According to Lie and colleagues (Lie *et al.*, 2008), a significant increase in the seat belt wearing rate was found in cars with seat belt reminders. For all observations, the total seat belt wearing rate was 97.5%. This might be an example of how policies evolve over a lengthy period of time.

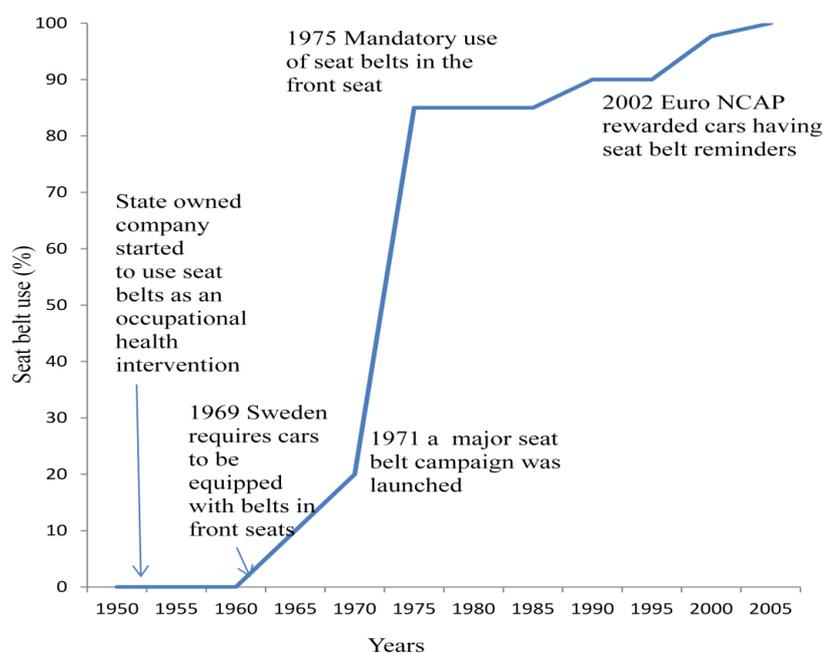


Figure 2. An example of the chronological sequencing of different policy instruments.

Choosing between different policy instruments may therefore be a much more complex process than the rational model indicates.

3 AIMS

The overall aim of this thesis is to increase knowledge of road traffic safety public policies and their implementation. This is achieved by exploring Vision Zero as a road traffic safety public policy, which was adopted by the Swedish parliament in October 1997, and by presenting two examples of implementation.

The thesis comprises four studies, which have the following specific objectives:

1. To examine Vision Zero as a road safety policy, which was adopted by the Swedish parliament in October 1997 (Study I).
2. To identify and analyze the Swedish official road safety targets adopted during the period 1972–2007, and – in accordance with the SMART criteria for target setting – evaluate whether the targets that were adopted actually succeeded in fulfilling these criteria or not (Study II).
3. To examine the experience of implementation and outcome of the Vision Zero principle of system designers taking responsibility for safety; further, to examine key factors that explain the outcome in relation to the first objective (Study III).
4. To go beyond the strict evaluation of speed cameras and their effects on road safety, and instead explore governance theories (Study IV).

4 METHDOLOGICAL APPROACHES

4.1 GENERAL CONCEPTUAL MODEL

Policy analysis can be carried out for different purposes, but several scholars (Hogwood and Gunn, 1984; Parsons, 1995) make a distinction between analysis of the policy process and analysis in the policy process. The aim of performing an analysis of the policy process is mainly to describe and explore that process in order to increase our knowledge of the policy process itself. Such knowledge might, of course, be used in order also to improve any particular policy process. Analysis in the process, on the other hand, is prescriptive by nature. In this thesis, the focus is on study of the road safety policy process.

The world is a complex place, and to analyze and develop understanding of this complexity, there is a need to simplify; that is why we construct models (Parsons, 1995). Accordingly, several scholars have developed, more or less complicated, system models (Easton, 1957; Parsons, 1995; Vedung, 1997). Based on these, a general analytic framework has been constructed (see Figure 3 below). The framework or model should not be seen as a description of a real-world road safety policy process. Rather, it is an analytic tool, which might be used to study complex social phenomena from an ideal-type perspective (Parsons, 1995). Basically, the model contains six sub-processes: road safety research, policy making, policy adoption, policy implementation, impact on road transport system, and finally the crash phase.

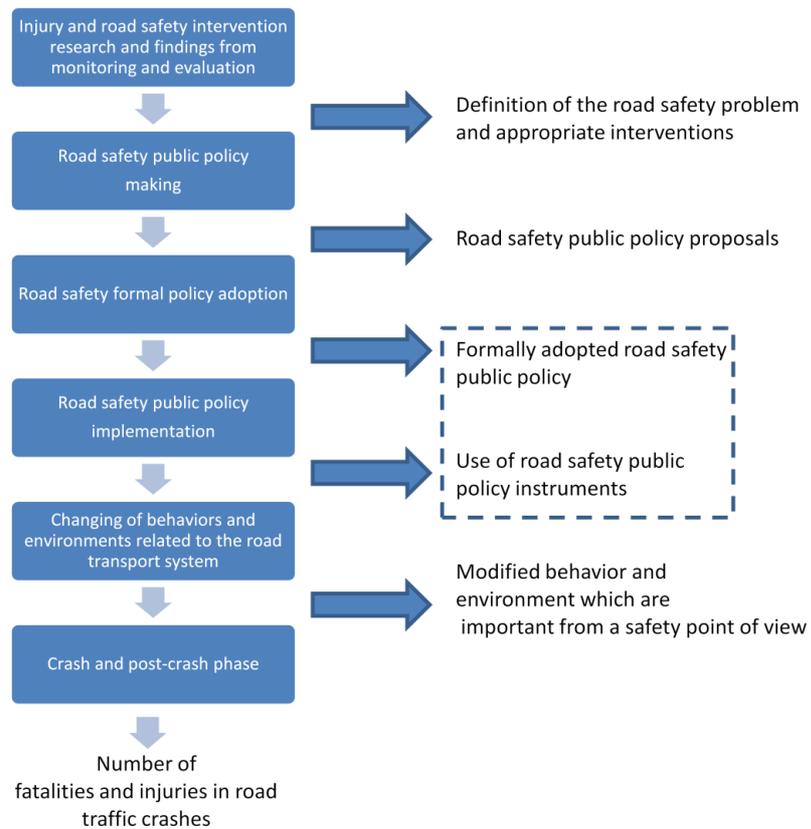


Figure 3. Analytic framework for a road safety ideal-type public policy process.

In this thesis, only a minor part of the entire policy process is discussed. In studies I–II, the focus is on the output of a policy adoption process, and in studies III–IV on the output of an implementation process. Within this general research approach, several methods and analytic approaches could be applied; the studies referred to in this thesis are all types of case studies.

4.1.1 Case studies

According to Yin (Yin, 1994), a case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, when the boundaries between phenomenon and context are not clearly evident; a case study approach can be adopted for exploratory, descriptive or explanatory purposes.

Further research questions, such as how and why, are likely to benefit from the use of case studies. This thesis can be seen as one overall case study of a road safety public policy, which contains four different studies of sub-cases.

Case studies include both single-case and multiple-case studies, and they have a distinctive place in evaluation research. For study IV, a multiple-case study approach was employed. For studies II and III, an evaluation approach was utilized.

4.1.2 Reconstructing public policy theory

To implement both general road safety policies, such as Vision Zero, and specific policy instruments, such as safety cameras, the purposive and organized effort consists in intervening in on-going social processes for the purpose of, in the Vision Zero case, eliminating deaths and serious injuries due to road traffic accidents and, in the case of safety cameras, preventing people from speeding. The questions of how to structure these organized efforts appropriately, and of why these efforts lead to desired outcomes, suggest that these efforts operate in accordance with some kind of theory.

Although these theories may be implicit or unsystematic, they provide general guidance for the formation of the policy and clarify how the policy is supposed to work (Chen, 1990). In the literature, intervention, policy and program theories are concepts that are usually used as synonyms (Hoogerwerf, 1990; Vedung, 1997; Patton, 2002; Rossi *et al.*, 2004).

A policy theory is generally defined as a set of interrelated assumptions, principles, and/or propositions that explain or guide social action (Chen, 1990). These theories are prescriptive by nature and stipulate how things are intended to work.

For studies I and IV, a policy and intervention theory approach was utilized. The purpose of policy and intervention theories is to describe how a policy is intended to be implemented and function (Mickwitz, 2003).

4.1.3 Evaluation approach

According to Vedung (1997, Page 3), the concept of evaluation can be defined as “careful retrospective assessment of the merit, worth, and value of administration, output, and outcome of government interventions, which is intended to play a role in future, practical action situations”. In study II the so-called SMART criteria were used in order to evaluate quantified targets, and in study III a process evaluation approach was adopted.

4.1.4 Materials and data collection

The political policy decision making process in Sweden is usually a structured and open process, based on the Swedish constitution (Swedish Government, 1974). The major stakeholders in this process are the Swedish parliament and its different committees the Swedish government office including its different ministries, and the different public agencies; finally, in the Swedish political system, a considerable source of information on past performance and alternatives for future policy action are produced by-ad hoc public policy commissions (Vedung, 1997).

A public policy process is therefore structured as follows. Usually, on the basis of a commission's proposals and responses to its consultations, a draft proposal or Government bill (proposition) is developed by the government and submitted to the Swedish parliament, and then treated in a parliamentary committee before being put before the parliament for decision. The outputs in terms of documents and minutes from public debate in the parliament before the decisions are all made public. Also, documents produced in the policy implementation process are largely made public. According to Swedish constitutional law:

“Every Swedish citizen shall be entitled to have free access to official documents, in order to encourage the free exchange of opinion and the availability of comprehensive information” (Swedish Government, 1974; Swedish Government, 1991).

Therefore, for all four studies, documents produced by governmental bodies have been utilized as the main source of information, and the contents of these documents have been analyzed. Furthermore, to a great extent, secondary data, based on the work of other researchers, have been used, especially in study IV. Finally, official statistics have been used. The overall study period is 1972–2009.

The different studies' focuses, specific objectives, methods and analytic approaches, and material and data collection are summarized in table 1.

Table 1. Summary of the methodological approaches adopted for this thesis.

Study	Focus	Specific objectives	Method and analytic approach	Materials/data collection	Time period for the data
I. Vision zero – a road safety policy innovation	Output from a formal adoption process	To examine Vision Zero as a road safety policy, which was adopted by the Swedish Parliament in October 1997.	Case study, policy theory	Government documents	1997
II. Quantified road safety targets	Output from a formal adoption process	To identify and analyze the Swedish official road safety targets adopted during the period 1972–2007 according to the SMART criteria for target setting; evaluation of whether the targets that were adopted actually succeeded in fulfilling these criteria or not.	Case study, evaluation	Government documents, official statistics	1972–2007
III. A step in the realization of Vision Zero	Output from a policy-implementation process	To examine the experience of implementation and outcome of the Vision Zero principle of system designers taking responsibility for safety; further, to examine key factors that explain the outcome in relation to the first objective.	Case study, process evaluation, and implementation theory	Government documents	1997–2009
IV. Speed cameras in Sweden and in Victoria, Australia	Output from a policy-implementation process	To go beyond strict evaluation of speed cameras and their effects on road safety, and instead explore governance theories.	Case study, comparative approach, policy theory	Government documents, research reports	1985–1992, 1998–2007

4.2 THE DESIGN OF EACH STUDY

4.2.1 Study I

In this study, a policy process framework was utilized in order to define the context. Thereafter, a case study (Yin, 1994) approach was applied. Documents produced in the decision making process were identified and analyzed. The analysis proceeded as follows: (1) the documents were read several times; (2) a number of questions were formulated on the basis of the texts; and (3) the questions were answered and presented in an analysis chart.

The analysis chart is based on the policy theory model (Hoogerwerf, 1990; Vedung, 1997; Patton, 2002; Rossi *et al.*, 2004). The following five questions were formulated: Which problems are to be solved? What is the long-term goal? On the basis of which general principles is the goal to be achieved? Who is responsible for safety? How should the principal players direct their work to create a safe road transport system? The answers to these questions constitute a reconstruction of the policy theory underlying Vision Zero.

4.2.2 Study II

This study was a retrospective case study (Yin, 1994), with a focus on what kinds of goals and quantified targets have been politically adopted in the road safety policy decision process in Sweden, and how these evolved during the period 1972–2007. The time period was chosen on the basis of the first year during which a public authority recommended a quantified road safety target.

The search process resulted in the identification of a total of 23 key documents, which were then analyzed in two steps. The first step was to examine how the goals and targets had been formulated, and the second step was to assess whether the quantified targets had been constructed according to specific, measurable, achievable, realistic and time-bounded criteria (SMART) (van Herten and Gunning-Schepers, 2000).

In order to estimate the likelihood of targets being achieved, the analysis sought information on whether decision makers based their discussions and decisions regarding the setting of proposed targets on any firm evidence. To analyze and estimate whether the targets adopted were realistic or not, a realistic target was defined in terms of the general trend in the number of fatalities between the time when the discussions on quantified targets began in 1972 and the latest adopted target for 2007, i.e. over a period of 35 years. 1194 people were killed in road accidents in 1972, and 471 in 2007. This is based on the assumption that what has occurred in the past continue into the future, provided that no new dramatic policy changes occur or unforeseen events intervene to change the course of events (Dunn, 1994).

4.2.3 Study III

In this study, the Swedish government and parliament were treated as implementers rather than policy makers.

The implementation process in terms of legislation in Sweden usually involves the following stages: a legislative matter is initiated; the government decides to appoint a commission of inquiry; the commission's report is referred to many different actors (stakeholders) in society. Based on the inquiry's proposals' and respondents' views, a legislative referral is made, which is then reviewed by the Council on Legislation. On the basis of the views of the Council, a final government proposal is made, which is treated in a parliamentary committee before being put before parliament for decision. Finally, the government enters the legislation that has been decided upon into the Swedish Code of Statutes (Government Office of Sweden, 2011).

This implementation process leaves many traces, in the form of inquiry directives, referrals, proposals and bills, reports of interested parties, and draft statutory texts. For this study, this comprehensive process was followed in-depth in order to identify and analyze key documents dealing with the ambition of regulating the responsibility of system designers. The materials and period of analysis is limited from the time when the preparatory work for the parliamentary decision on Vision Zero began, in October 1997, up to 2009, on the ground that 2010 was the year in which the Swedish Road Administration was closed down.

To identify key documents, the parliamentary database, www.riksdagen.se, was scanned – using keywords such as Liability, Road Traffic, Vision Zero and Traffic Safety. The search identified a number of documents that have a bearing on the legislative process surrounding safety liability for system designers. On the basis of this material, it was possible to map and reconstruct the legislative process.

To give a deeper understanding of the legislative process in the analysis, a theoretically based explanatory model was developed. This model includes four main explanatory factors: the background and complexity of the intervention, conflicts of interest, other efforts, and other processes. The model is based on previous experiences of implementation and evaluation research (Wilson, 1980; Winter, 1989; Vedung, 1997).

4.2.4 Study IV

In order to explore the ideas underpinning the adoption of speed camera systems, a case study research strategy was adopted (Yin, 1994). For this study, an intervention theory approach was utilized (Hoogerwerf, 1990; Patton, 2002; Rossi *et al.*, 2004; Vedung, 1997b) in order to reconstruct the different government intervention theories that underpinned the two camera systems.

The following research questions guided the analysis: (1) What is the main problem to be solved by the two speed camera systems? (2) What is to be achieved by the two systems? (3) What do the intervention mechanisms look like? (4) In what way are road safety effects intended to be achieved by the two systems? (5) What are the main similarities and differences between the two systems?

Evidence of similarities and differences was collected from different source documents produced in connection with the two different implementation processes. To identify key documents, a snowball technique (Patton, 2002; Trochim, 2006) was applied, and – in a step-by-step approach – several key documents containing evidence about the different systems, both the underlying ideas and descriptions of the systems and their components, were identified.

4.3 ETHICAL CONSIDERATIONS

All studies were approved by Karolinska Institutet's regional research ethics committee (ref no. KI 01-224 Å 288).

5 MAIN FINDINGS

This section describes some of the main findings of studies I–IV.

5.1 VISION ZERO – A ROAD SAFETY POLICY INNOVATION (I)

Vision Zero as a road safety policy, which was adopted in 1997 by the Swedish parliament, represents, according to this study, an innovative alternative framework in Sweden.

According to Vision Zero as a public road safety policy, the fundamental causes of the traffic safety problem can be found in shortfalls in the design and function of the present road transport system, which thereby, to a large extent, contributes to the risk of road users being subjected to a form of external violence that significantly exceeds what a human being, purely physiologically, is capable of withstanding. The consequences of one single misjudgment or one single mistake in road traffic can be a matter of life and death.

According to Vision Zero, the long-term goal of traffic safety should be that no-one is killed or seriously injured as a consequence of accidents within the road transport system. The design and structure of the road transport system should be adapted to the requirements that follow from Vision Zero. People's physical prerequisites for withstanding external violence in connection with traffic accidents should be normative in the design of a road transport system. With this as a basic point of departure, a traffic-safe society can develop in the long term.

Vision Zero envisages a new division of responsibility. The responsibility for traffic safety should be shared between traffic users and so-called system designers as follows: system designers have the ultimate responsibility for the design and function of the road transport system; road users are responsible for complying with current traffic regulations, and showing consideration, a sense of judgment and responsibility. If long-term ill-health nevertheless occurs, or there is a risk of it occurring, the system designers must take further measures.

According to Vision Zero, the Swedish Road Administration, the police and local authorities should basically endeavor to ensure that: the prerequisites, needs and demands of citizens are the point of departure for long-term goal-oriented traffic safety activities; decision makers within the private and public sectors are encouraged to take greater responsibility for traffic safety; the private bodies concerned are encouraged to integrate consideration of traffic safety into all the parts of their operations that influence the design and function of the road transport system; citizens are encouraged to make demands for traffic-safe products and services; and, the interest of and chances of road users complying with traffic regulations, and showing consideration, a sense of judgment and responsibility in traffic are increased.

Vision Zero, as a road safety policy, was adopted by the Swedish parliament in October 1997 and all the political parties, except the Green Party (Miljöpartiet), voted for this new long-term goal. The Green Party was not against Vision Zero as such, but wanted Vision Zero to be combined with more specific sub-goals.

5.2 QUANTIFIED TARGETS: THEORY AND PRACTICE IN SWEDEN (II)

Politically adopted road safety goals in general, and quantified time-bounded road safety targets in particular, are policy strategies that have evolved since the beginning of the 1970s. 1982 was the year when the Swedish parliament first adopted qualitative goals. These were as follows: the total number of people killed and injured in traffic should steadily decline; the risk of being killed or injured in traffic should steadily be reduced for all categories of road users; the risk of being killed or injured in traffic should be reduced to a greater extent for vulnerable road users than for protected road users; and, particular attention should be paid to the problems of children in road traffic.

In 1989, based on a proposal from what was then the Swedish National Road Safety Council, the Swedish parliament accepted, for the first time, a quantified time-bounded road safety target for 2000 as an operative objective for road safety work. In 1996, this target was, mainly due to a positive road safety trend, tightened up; and, in 1997, the short-term target was accompanied by a new long-term goal, named Vision Zero. At the same time, the qualitative goals adopted in 1982 were abandoned. In this study, three adopted road safety targets were identified, all of which were specific, measurable, time-bounded, and at least theoretically achievable. However, it seems that the targets adopted in 1996 and in 1998 were, compared with the general historical trend, more or less unrealistic.

5.3 A STEP IN THE REALIZATION OF VISION ZERO (III)

Vision Zero has a fundamentally new approach to the allocation of responsibilities for the prevention of traffic injuries. It includes designating system designers as having overall responsibility for safety. In this study, the Swedish government and parliament change in nature from policy makers to policy implementers.

Having evaluated the process and outcome of regulating system designers' formal responsibility for safety, the study concludes that the goal has only been realized to a minimal degree. The Swedish government and parliament have to only a small extent transformed their intention of a system designer's responsibility for safety into concrete formal legislation that covers all system designers. This appears to be attributable to four principal explanatory factors: operational background and complexity, conflicts of interest, other efforts, and other processes. With the help of the EU and the growing importance of environmental issues, safety responsibilities have become regulated in part, but there remains a lot to be done if the ambition is to achieve comprehensive formal safety liability for all system designers.

5.4 SPEED CAMERAS IN SWEDEN AND VICTORIA, AUSTRALIA (IV)

The study shows that even if the system in Victoria, Australia and the Swedish system technically have the same aim – to reduce speeding – ideas on how that should be achieved differ substantially.

The program applied in Victoria is intended to solve the problem of having a large proportion of drivers who continuously exceed speed limits, and thereby create road safety problems. The purpose is to achieve a massive increase in the likelihood of detection, and is accompanied by a high-level advertising/public education campaign to inform drivers of the risks of speeding and of the risks of getting caught. The Victoria approach clearly focuses on driver behavior, and the speed camera program attempts to create a feeling among drivers that speeding can be detected at any time and in any place in the road system. In order to achieve this sense of continued surveillance, the intention is to catch a large proportion of the drivers who exceed the speed limit, so that they experience the consequences and avoid re-offending (specific deterrence), and, in turn, that these drivers tell other drivers that they have been caught (general deterrence). The road safety effect in the Victoria system is supposed to be achieved on the basis that the perceived risk of being detected and fined will prevent a large proportion of drivers from speeding; therefore, the average driving speed in the whole system will decrease, as too will the number of fatalities and injuries.

In the Swedish speed-camera program, the focus is more on dangerous environments. The main road safety problem is seen as lying in a situational imbalance between the road network and its safety level, and the speed at which people choose to travel. The reason for using automatic road safety control is to achieve a preventive effect in places that have been assessed as dangerous, and where there is poor speed adaptation and no other countermeasures are planned. The basic issue is therefore to address the inherently dangerous design of the environment. The cameras are supposed to support and create a new social norm among drivers, namely that it is easier and better to follow stipulated speed limits. The catching of drivers by the system is regarded as an undesirable consequence. Everyone should know where the cameras are located, and voluntarily adjust their speed accordingly. In the Swedish system, information on the existence of cameras should help most drivers voluntarily to respect the speed limits, which means that both the average speed and the number of fatalities and injuries will decrease.

6 DISCUSSION

6.1 VISION ZERO AS AN INNOVATIVE PUBLIC ROAD SAFETY POLICY

In study I and II the focus has been on formal adopted road safety public policies (see figure 3 above). In this section the findings from these studies will be discussed.

Study I has shown that Vision Zero as public policy is, to a great extent, based on what can be called the injury model. There seem to be two ideal types of approaches to road traffic injuries and fatalities as a major health problem and its causes: the accident model, and the injury model.

In Sweden, as early as in the 1930s, road users were regarded as being the main cause of almost 90% of all road accidents (Kommunikationsdepartementet, 1940). This figure has remained the same over the years and, according to Evans (2004), road-user behaviors were found to be the sole or contributory factors in 94% of crashes in a British study, and 93% in a US study. Evans has pointed out, however, that these studies need to be interpreted with caution because identifying the mix of factors is not the same as identifying the most effective mix of countermeasures. He argues that it is change in human behavior that has the potential to make the greatest improvement in traffic safety. In general, the accident model has been the most prominent model, and, to a great extent, it has influenced public policies and strategies in the road safety arena over the years. Research by Friedland and colleagues (1990) has shown clearly how governments historically have heavily relied on policing and prosecuting individual road users in order to control accidents.

The injury model was mostly developed by William Haddon (Haddon, 1970a; Haddon, 1970b; Haddon, 1973; Haddon, 1980). According to this model, there are injury thresholds in body mechanical energy exchanges, and these thresholds, together with impact conditions, solely determine the injury outcome when specific amounts of energy are dissipated. Thus, the problem is not a priori to prevent accidents per se, although it might be an important strategy to prevent energy impacts above critical thresholds. Stigson's thesis (2009) is a topical example of the use of this injury model to analyze real crash data. According to Stigson (Stigson *et al.*, 2008), deficiencies in the traffic environment and vehicle system are the main causes of approximately 63% of traffic deaths (Stigson, Krafft, & Tingvall, 2008). This finding entails that a different road and vehicle design, which improves the tolerance of human beings to external violence, would mean that at least 63% of all deaths could be avoided.

In study I, it is shown that Vision Zero as a road safety policy represents an innovative and radical approach to the promotion of road safety, and also that Vision Zero is not just a new long-term goal. It also offers a new direction for road traffic safety work, which appears to emanate from a desire to effect a policy shift in performance of that work. According to study II, a long tradition of policy development and successful systematic road safety work lies behind Vision Zero. It seems that we have a kind of chronological sequencing of goal and target setting in Sweden, which reached its peak when the Swedish parliament adopted Vision Zero as a new long-term goal.

Why do politicians adopt ambitious goals and targets despite the fact that they have endorsed other conflicting goals and targets, and also might not have the implementation capacity in place to achieve the stipulated goals and targets?

One reason for this, as it is shown in study II, is that setting goals and time-bounded quantified targets is a policy action in itself, aimed at motivating different stakeholders. The underlying objective is not to achieve the goals and the targets, but to increase public awareness of the road safety problem, and thereby impose pressure on stakeholders to strengthen their efforts. There is some evidence in support of this view. It is the highest or most difficult goals that produce the highest levels of effort and performance (Locke and Latham, 1990; Locke and Latham, 2002). The logic is similar to that in the old adage: aim for the stars and you will reach the top of the mountain.

However, Vision Zero is controversial and the policy has, in connection with research work and debate, been questioned and criticized. The criticism has mainly focused on Vision Zero's ambition to eliminate all deaths and serious injuries on the roads (Ekelund, 1999; Elvik, 1999; Lind and Schmidt, 2000). According to this criticism, there is a risk that Vision Zero could lead to the setting of erroneous social priorities, and to various undesirable social side-effects, which might, for example, justify measures that seriously infringe on personal freedom (Rosencrantz *et al.*, 2007). However, it is difficult to assess the credibility of this criticism prior to implementation, and some example of Vision Zero implementation will be discussed in the following section.

There seem to be two major approaches to goal and target setting: the top-down, and the bottom-up. In the first case, goals and targets are set without too much prior consideration of how they can be reached in terms of safety measures and at what cost. In the second case, goals and targets are based on the estimated effects of the available set of road safety measures; thus, the required budget can be estimated at the same time (OECD, 2002). Vision Zero and some of the targets adopted, as described in study I, are examples of goal setting from a top-down perspective (Rosencrantz *et al.*, 2007). Underpinning these two perspectives on goal setting are two different ethical systems, namely the consequentialist and the deontological, that are difficult, at least in the long run, to combine.

In consequentialism, the morality of a decision is judged by its expected outcome (utility) rather than the decision itself. In deontology, the decision maker must decide the ethical course of action by reason alone, basing his or her moral judgment on autonomous rationality, with the overall imperative of performing her or his moral duty (Bowen, 2012). Thus, Vision Zero entails a shift in the road safety planning paradigm.

Instead of starting from an existing problem and existing road safety interventions, Vision Zero takes its point of departure in an absolute state of the future – safe road traffic. Instead of posing the question ‘What can be done?’, the question is ‘What must be done in order to create a safe road transport system?’ As a policy, Vision Zero requires a planning model that involves what is called ‘backcasting’ (Kane, 2009; Roome, 1998).

As shown in the introductory section, Vision Zero as a public policy is not only built on efforts to combat road traffic injuries, it is also built on a long tradition of general goal-oriented injury prevention work in the whole of Swedish society. The strategic shift in the late 60s from behavior-modification strategies to environment and protection-oriented strategies for children (Sandels, 1974; Jansson *et al.*, 2006) have had a great impact on this policy, although it is also directed at all road users.

6.2 VISION ZERO IMPLEMENTATION

In study III and IV the focus has been on implementation of public policy instruments (see figure 3 above). In this section the findings from these studies will be discussed.

As shown in study I, Vision Zero is not only a new radical goal. It also stands for a fundamentally new approach to the allocation of responsibilities by making system designers, and not just road users, responsible for road safety. From that point of view, Vision Zero as a policy is a top-down phenomenon.

System designer is a diffuse concept but, according to the government, it refers to "the public and private agencies responsible for the design and operation of various parts of the road transport system, such as roads, vehicles and transport services, and those responsible for various support systems for safe road traffic, such as regulations, education, information, surveillance, rescue, care and rehabilitation (Swedish Government and Committee on Transport and Communications, 1997). State and municipal road-maintenance authorities, vehicle manufacturers, driving schools, transport companies and healthcare providers are among the other stakeholders who are definitely covered by the definition of system designer. In fact, there are not very many actors in society who are excluded on that definition, apart from individual road users.

According to study III, the government and parliament process of regulating, one of the main policy instruments in the governmental toolbox, as it applies to system designers' formal responsibility for safety, has been slow, and the goal of regulation has only been minimally realized. This low level of performance appears to be attributable to four principal explanatory factors (Wilson, 1980; Winter, 1989; Vedung, 1997): operational background and complexity of the reform, conflicts of interest, other efforts, and other processes. These findings lend support to the general hypothesis that politically expressed intentions are often difficult to realize in practice (Sabatier and Mazmanian, 1979; Vedung, 1997; Rothstein, 1998).

On the other hand, the idea of system designers having liability for safety has definitely taken root and, as is shown in study III, a large number of other interventions, such as using information and economic instruments, have been carried out by the Swedish government for the purpose of influencing different system designers. All these activities may indicate that society is in a kind of policy-incremental (Lindblom, 1979) learning process (Sabatier and Jenkins-Smith, 1993), and that the process is an example of an on-going package of processes comprising different policy instruments. Such a process might start with the use of a 'soft' kind of information instrument until society becomes ready for more intrusive instruments, such as regulation.

Although Sweden showed an interest in automatic speed surveillance systems as early as the late 1980s, it was not until 2006, according to study IV, that the Swedish Road Administration (Vägverket), together with the Swedish National Police Board (Rikspolisstyrelsen), started to implement a large-scale speed camera program, or, as it is called in Sweden, a road safety camera program.

Vision Zero, with its focus on kinetic energy control, system designers' responsibility, and its new approach to the role of citizens and road users, has had a great impact on the ideas underpinning the safe camera program. According to study IV, its implementation was a part of an 11-point program to achieve the quantified road safety target for 2007, and to make an important contribution to Vision Zero (Swedish Government, 1999).

The Swedish system, as measured by cameras per capita, is probably one of the largest systems in the world (Sagberg, 2000). It is an example of how system designers (e.g. the road authorities and police), together and in line with system designer's responsibility, have developed a road safety system to support road users and their speed adaption. According to Vision Zero, speed and its consequences is one of the most fundamental aspects that needs to be controlled.

From a strict cost-benefit point of view, however, the Victorian approach seems preferable to the Swedish one. As is discussed in study IV, the choice of different policy options is not only guided by value criteria, like effectiveness and efficiency, but also by criteria such as legality, legitimacy, democracy, feasibility, etc. (Bemelmans-Videc *et al.*, 1998; Runyan, 1998).

In summary, there is some evidence from study IV indicating that Vision Zero, as a new policy, leads to erroneous social priorities from a cost-benefit perspective. Nevertheless, the question is whether cost effectiveness and cost efficiency are the only criteria to count? There are no signs that Vision Zero leads to surveillance systems that constitute a major threat to people's freedom. To the contrary, according to national road safety attitude surveys, the policy seems to act as inspiration for an open and road user friendly application of a camera system; in a recent survey, 71% of responders were found to be in favor of automatic speed surveillance with safety cameras (Trafikverket, 2011).

Study IV shows that choice of policy instruments is complicated, and that the process will vary with the background roles and cognitive orientations of policy makers, and also with the contextual factors that have historically influenced views on the instruments embedded in the implementation structure (Bemelmans-Videc *et al.*, 1998).

6.3 METHODOLOGICAL CONSIDERATIONS

According to Yin (Yin, 1994) there are four basic tests commonly used to evaluate the quality of empirical social research: construct validity, internal validity, external validity, and reliability. Construct validity identifies correct operational measures for the concepts under study. Internal validity seeks to establish causal relationships, as distinguished from spurious relationships, whereby certain conditions are believed to lead to other conditions. External validity defines the domains to which a study's findings can be generalized. Reliability demonstrates that the operations of a study can be repeated, with the same results. Methodological aspects are discussed in each of the studies, but in this section some general issues are worthy of attention.

As a road safety practitioner and an employee of the former Swedish road administration, I have been involved in some of the processes, at least in part, that have been studied, and there may be scope for impartiality on my part, which may have influenced the research in both positive and negative ways (Buse *et al.*, 2005).

It could have influenced the research positively because of a practical and theoretical pre-understanding, which improved the research design, data collection and the analysis of findings, and thereby enhanced construct validity. However, it could also have influenced the research negatively, mainly because of the possibility of biased interpretations, which could be a threat to the studies' reliability. Three strategies have been pursued in order to maximize positive and minimize negative bias.

First, the policy theory approach has been applied to a great extent. This is a method that makes the theories underpinning both policies and their implementations more explicit and therefore increases the studies internal validity. Of course the theories can be wrong, but at least they are made explicit, and therefore exposed to critical assessment, and improved through additional research.

Second, interviewing as a method, which is common in studies of policy processes (Robson, 1993; Yin, 1994) has not been applied, mainly due to difficulties in interviewing peers, but also because the focus has been on the contents of adopted public policies, not on the processes. Instead, data have mainly been collected from official documents produced in public policy processes. Documentation is a so-called unobtrusive measure; that is, the nature of a document is not affected by the fact that you are using it for the purpose of enquiry (Robson, 1993). It is important that documents are seen in their context in order to assess their trustworthiness (Guba and Lincoln, 1994). The context includes the purpose of the document, as well as institutional, social and cultural aspects. From an international perspective, Sweden is unique in its open policy process, which makes it a gold mine for people interested in policy research. However, there may be a risk that some parts of the policy process become concealed from research because of the requirement of public access to documents (Ahlenius, 2003).

Finally, a comparative approach has been applied in one of the studies. In addition to this, both of my supervisors were entirely outside the processes that have been studied, and therefore contributed to providing a more nuanced interpretation of underlying processes and their contents. The question of this research and its external validity in terms of generalizability to road safety policy making and implementation will be discussed in the following section.

6.4 POLICY ANALYSIS IN ROAD SAFETY RESEARCH

As has been mentioned in the introductory section, the focus of road safety research has been mainly on the magnitude of the road safety problem, important risk factors, and theoretical as well as practical experiences of effective road safety policy instruments. Empirically based road safety policy analysis seems to be weakly developed. Road safety policy making and road safety policy implementation are, to a large extent, blind spots when it comes to systematic research.

However, some research has been carried out to develop our understanding of the reasons for use and non-use of knowledge in the road safety policy process (the link between research and policy making in figure 3 above) (Kolbenstvedt *et al.*, 2007; Bax, 2011), the use of quantified road safety targets (Elvik, 1993; Wong *et al.*, 2006; Kolbenstvedt *et al.*, 2007), and road safety management (Elvik, 1993; Elvik, 1999; Elvik, 2003; Elvik, 2008; Elvik and Vaa, 2004; Wegman and Hagenzieker, 2010). A general assessment of this research reveals that it is heavily based on the paradigm of rationality, with a normative prescriptive approach to improving policy making and policy implementation.

It is not only in the road safety sector that this rational model is present. According to Bugeja and colleagues (Bugeja *et al.*, 2011), it is also the dominant model in the general arena of public health. The public health approach to injury prevention is usually described in four stages: define the problem, identify causes, develop and test interventions, and implement effective interventions (Mohan *et al.*, 2006). This is an ordered process that begins with the delineation of the nature and extent of an injury problem through the systematic collection of information about its magnitude, scope, characteristics, and consequences. The process then involves a determination of the risk and protective factors that can be modified through intervention. Countermeasures, and also strategies for implementing these countermeasures, are then generated to address the modifiable factors. The efficacy of both the countermeasures and strategies are quantified, and effective interventions are then scaled up into programs for implementation and dissemination at a population level (Bugeja *et al.*, 2011). In this model, policy formulation, policy adoption and policy implementation are not present (by contrast with the model presented in figure 3 above).

Based on this rational paradigm, certain common beliefs seem to have evolved among road safety experts around the world, namely that road safety is scarcely a prioritized objective in society, and that, in practice, road safety instruments are ineffective. For example, according to Trinca and colleagues (Trinca, 1988), and by contrast with emphasis on the fundamental importance of mobility, traffic safety is peripheral, a by-product of the road transport system; but crashes are something to avoid while achieving the mobility objective.

The Road Safety Handbook (Elvik and Vaa, 2004) also points to a lack of interest in road safety, and suggests that one problem is that public bodies only have a relatively small direct financial interest in its improvement. It is not only mobility that plays a role as a barrier to road safety.

According to Trinca (Trinca, 1988) road safety ranks disproportionately low among public perceptions of social and public health problems, possibly because, although the magnitude of the problem is large on aggregate, the risks are very low at the level of the individual. Therefore, other values, such as personal freedom, are more important (Køltzow, 1993; Evans, 2004).

According to Elvik (2010), studies of actual priorities in road safety policy, in particular in the Scandinavian countries, suggest that the priorities are inefficient. This analysis is similar to that of Rothstein, where he refers to 'misery research' (Rothstein, 1998).

Road safety policy making and implementation are complex processes. The studies in this thesis only cover small parts of the area, and therefore their findings can scarcely be generalized to road safety policy making and implementation in general. However, they do show that short-term rational comprehensive models heavily based on calculations are probably not enough to understand road safety policy processes. The road safety policies that have been implemented are astonishing from a historical perspective in terms of progress, and Vision Zero is a remarkable example of political commitment to road safety, which can hardly be understood from a perspective where road safety has a low priority in society. Bringing in criteria such as legality, legitimacy, democracy, feasibility, etc. (Bemelmans-Videc *et al.*, 1998; Runyan, 1998) makes the assessment of successful implementation much more complex. Moreover, it is obvious that the more mechanistic and rationalistic view of the implementation process underestimates the time factor.

Although this thesis, with its studies, has developed some knowledge about road safety public policies, which have been introduced to address a major public health problem, namely traffic fatalities and injuries, we still lack systematic knowledge of the ways in which different public authorities and private organizations, in different time periods, have tried to tackle this major problem. There is inadequate understanding and interpretation of the dynamics of processes aimed at formulating and implementing road safety policies, and also of how sound road safety interventions are disseminated in society.

Improving road safety requires knowledge of implementation processes, of measures known to be effective, and of how and where, in other sectors of society, road safety aspects have been mainstreamed and partnerships built. It also requires the ability to choose the strategies and approaches that best fit the specific conditions of different countries. As is shown in section 2, there are several promising models and theories, developed in other research fields, that could also be used in road safety policy research.

6.5 FINAL REMARKS

Regardless of attitudes to the Vision Zero public policy, it has been widely distributed throughout Sweden and its surroundings. A search on Google (<http://www.google.se/>, 2012) gives 73,400 hits on Nollvisionen, the Swedish term for Vision Zero, while the English term Vision Zero receives 224,000,000 hits. Swedish traffic safety policy therefore not only has a direct impact on the Swedish road transport sector and its stakeholders, but it has also achieved a wide distribution that would have been difficult to foresee at the time of the parliamentary decision in 1997.

There is also considerable interest being shown in Vision Zero on the part of various international organizations. One example is the way Vision Zero is being handled by the World Health Organization (WHO), and another in the World Bank's (WB) first global report on traffic injuries in the world for 2004 (Peden *et al.*, 2004). Other examples include the Organization for Economic Co-operation and Development's (OECD) report entitled Ambitious Road Safety Targets and the Safe System Approach (OECD/ITF, 2008), and the statement of the Council of the European Union on 3 December 2010 to the effect that the European Union shall in the long term aim at achieving Vision Zero (Council of the European Union, 2010; European Parliament Committee on Transport and Tourism, 2011).

Vision Zero, as a phenomenon within public policy, has also spread to the entire transport sector (Swedish Government and Committee on Transport and Communications, 1998), and also other policy areas, such as the prevention of suicide (Swedish Government and Committee on Health and Welfare, 2008). And another example of an area for which the introduction of a Vision Zero is being argued for is bullying (Barnombudsman Nyberg, 2005). Vision Zero is not only a public policy; it has also started to spread onto the market:

“By 2020, nobody shall be seriously injured or killed in a new Volvo” (Volvo, 2012).

Injuries in general, and road traffic injuries in particular, are not equally distributed across the population within Sweden (Skadeforskningsgruppen, 1999), or globally between different countries (Peden *et al* 2004). Vision Zero, as a public policy, adopts a clear stance on this. As it is expressed in the first paragraph of the Tylosand Declaration (Swedish Road Administration, 2007):

“Everyone has the right to use roads and streets without threats to life or health”

This paragraph can be interpreted to mean that, despite socioeconomic differences between people in a country or between countries, every road user has the right to safe mobility. However, it is a great challenge to deliver a safe system for everyone, especially for those road users who, for different reasons, choose deliberately to challenge the design of a safety system (Stenbacka *et al.*, 2011). To ensure safety for unprotected road users in high-speed vehicles (e.g. motorcyclists) is also a great challenge (Trafikverket, 2010).

7 CONCLUSIONS

Vision Zero as a road safety policy represents an innovative and radical approach to the promotion of an alternative framework in Sweden with regard to road safety problem formulation, views on responsibility, attitudes to the demands of road users for safety, and the ultimate objective of road safety work.

Behind Vision Zero lies a long tradition of policy development and successful systematic road safety work in Sweden; over the years, there has been an evolution of goals and targets, which reached its peak when the Swedish parliament adopted Vision Zero as a new long-term goal.

Vision Zero is a politically adopted policy, which takes the clear ethical stance that everyone has the right to use roads and streets without threats to life or health. Setting ambitious goals and almost unrealistic targets is a policy action in itself, aimed at motivating different stakeholders. The underlying reason is not directly to achieve the goals and the targets, but to increase public awareness of the road safety problem, and thereby impose pressure on stakeholders to continuously strengthen their efforts.

Vision Zero envisages a new division of responsibility. Responsibility for traffic safety should be shared between traffic users and so-called system designers as follows: system designers have the ultimate responsibility for the design and function of the road transport system; road users are responsible for complying with current traffic regulations, and showing consideration, a sense of judgment and responsibility. However, if long-term ill-health still occurs, or there is a risk of it occurring, the system designers must take further measures. But, due to operational background and complexity, conflicts of interest, other efforts, and other processes, the principle of a new division of responsibility has only been implemented minimally in formal legislation.

By contrast with the speed camera system in Victoria, Australia, the Swedish road safety camera system appears to be based on a belief that road safety is an important priority for road users, and also that one of the reasons why road users drive too fast is a lack of information and social support. Therefore, the underlying aim of the intervention is to support and create a new social norm among drivers, namely that it is easier and better to follow the speed limits.

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