

**Mission-oriented innovation policy:
The case of the Swedish ‘Vision Zero’ approach to traffic safety**

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The case of the Swedish ‘Vision Zero’ approach to traffic safety

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Abstract: There is an increasing consensus among policy makers and academics that Mission-oriented Innovation Policy is needed to tackle the grand societal challenges of our time. However, there is little experience in actually carrying out this new type of policy. In this light, we investigate Sweden’s ambitious traffic safety policy known as ‘Vision Zero’. We consider this policy as a mission-oriented innovation policy towards a societal challenge, as it started from the articulation of a bold, societal goal (zero traffic deaths), fostered multiple types of innovations (technological infrastructural, regulatory), and involved a variety of actors (public, private and professional organizations). We explain what the Vision Zero policy entails, how stakeholders dealt with ‘transformational failures’, and what made the policy a success. We end with lessons for the development of new mission-oriented innovation policies to address societal challenges.

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1. Mission-oriented Innovation Policy

Innovation policy, in part, consists of mission-oriented policies that direct efforts of multiple actors towards reaching a concrete goal. The notion of missions refers to NASA's mission to put a man on the moon in the 1960s. The achievement of this goal could obviously not be left to the market nor to scientists alone. Instead, a dedicated organization needed to be created bringing together a diverse set of expertise with strong political backing. A similarly successful example of mission-oriented innovation policy has been the development of high-speed trains by the French government in the late 1970s.

Mission-Oriented Innovation Policy is currently making a revival (Mazzucato, 2018; Schot & Steinmueller, 2018), also in the context of transport innovation (Bugge et al., 2021). This revival is motivated by the need to address today's grand societal challenges, notably global warming, biodiversity loss and ageing populations. Contrary to the past missions which were characterized by a technological challenge, today's missions are motivated by societal challenges. Most prominently, global warming is threatening the livelihoods of millions of people. Similarly, biodiversity loss and chemical pollution is affecting food production and human health in a myriad of ways. To tackle these challenges, production and consumption will need to change drastically. Apart from challenges of an environmental kind, there are other societal challenges often noted by politicians including cybersecurity, obesity, ageing and mental health.

While these societal challenges are all quite different, they have in common that the problems that need to be tackled, are 'wicked' (Wanzenböck et al., 2020). Wicked problems are characterized by:

- *contestation*, resulting from divergent claims, values and framings;
- *complexity*, resulting from the multitude of relevant actors and geographical scales (local, national, global) causing a 'problem of many hands' (Thompson, 1980);
- *uncertainty*, resulting from limited knowledge to develop effective policies.

Traditional innovation policies are considered to be unfit to deliver solutions to wicked problems. In most high-income countries, traditional innovation policies focus on supporting innovative firms, in particular, by subsidizing R&D personnel, stimulate collaboration with universities, and granting them patent protection (Schot & Steinmuller, 2018; Wanzenböck et al., 2020). However, as there is no well-developed market for societal problems (being externalities or public goods), firms are unlikely to develop effective solutions to them. Instead, government itself may have to take the lead.

For governments to be effective in mission-oriented innovation policy, they must avoid a number of pitfalls. In this context, Weber and Rohracher (2012) argued that a new type of innovation policy is needed that is 'transformative'. Rather than leaving it to firms to develop innovation within the context of existing markets and regulations, government should take the lead in providing 'directionality' to innovative activities – including those by firms – as to transform society. One type of transformative innovation policy is the use of missions: setting a bold and well-defined goal and providing funds and a policy mix to reach such a goal. A policy mix here refers to a combination of policy instruments. The articulating of what is called a 'mission' can

guide the creativity and investments of many different actors into a particular direction. The key example today is innovation policy in the energy domain, following the target set for countries in the Paris agreement from December 2015 (to limit global warming to below 2 degrees Celsius, preferably to 1.5 degrees Celsius).

To tackle societal challenges, it is not just about coming up with innovative solutions, but also about having these solutions diffuse within society. Hence, mission-oriented innovation policy involves a much broader policy mix than traditional innovation policy, as it does not only focus on innovation but also on diffusion, involving stimulating new markets (e.g. by public procurement or product subsidies), the development of new regulations and standards (e.g., regarding the phasing out of harmful technologies or minimum performance standards) and inducing behavioral change (e.g., through information campaigns and training schemes). As so many policies are needed at the same time, a key aspect of mission-oriented innovation policy is to provide coordination among ministries and among government levels (municipality, province, state, Europe) (Hekkert et al., 2020; Larrue, 2021).

While there is an increasing consensus among policy makers and academics that mission-type of policies are needed to tackle the grand societal challenges of our time (Schot and Steinmuller, 2018; Wanzenböck et al., 2020; Larrue, 2021), there is little experience in actually carrying out such an ambitious policy. While there has been some experience with technological missions – such as the aforementioned man-on-the-moon and high-speed train projects – the lessons learnt from technological challenges do not necessarily carry over to societal challenges. Technological challenges are not so wicked as societal challenges, as there is a clear technological goal for which a dedicated organization can be created under government control. Instead, in the case of missions for societal challenges, the articulation of the mission itself is an important process in its own right. The articulation of the mission, and follow-up policies, should then mobilize a variety of actors in a distributed manner rather than within a single government organization. If this process of ‘demand articulation’ involves relevant actors, has broad political support and is clearly defined and measurable, the formulation of the mission reduces the wickedness. The policy can then set in motion a coordinated and reflexive process among various actors (Hekkert et al., 2020; Wanzenböck et al., 2020).

While mission-oriented innovation policy towards societal challenges has emerged very recently, we may still learn from policies in the past that – with hindsight – can be understood as policies with a societal mission. In the Netherlands, for example, the persistent challenge to avoid massive flooding has led to a new type of water policy that involves controlled flooding of designated areas (Van Staveren et al., 2014). Other examples include re-structuring polluted areas (Coenen et al., 2018) and anti-smoking policies (Wanzenböck et al., 2020).

Here, we report on Sweden’s ambitious traffic safety policy known as ‘Vision Zero’. We consider this policy as a mission-oriented innovation policy towards a societal challenge, as it started from the articulation of a bold, societal goal (zero traffic deaths) and involved all sorts of innovations from a variety of actors (public, private and professional organizations). This chapter first explains what the Vision Zero policy entails and then investigates the factors that made it a success and also the policy failures that were not overcome. We then draw lessons for the development of new mission-oriented innovation policies to address societal challenges in

transport. The research was based on fourteen interviews with key people involved in the policy over the years including employees at Trafikverket, the governmental body that works on Swedish road traffic infrastructure and safety, employees in other governmental bodies and employees at private firms connected to Vision Zero. As part of the interview series, we also discussed with two fellow academics from Sweden with expert knowledge on Vision Zero.¹

2. Vision Zero

Vision Zero is a traffic safety policy introduced by the Swedish government in 1997 (Ministry of Transport and Communications, 1997). The objective of the Vision Zero policy holds that “*eventually no one will be killed or seriously injured within the road transport system*” (Tingvall & Haworth, 1999, p. 1). While a specific time span is not provided to reach the goal of zero, the vision was introduced with a long time-span in mind (Belin et al., 2012). Its long-term orientation, as well as ambitious aim to bring fatalities to zero set the policy apart from different traffic safety policies (Johansson, 2009). Before Vision Zero, traffic safety policies were built around reducing fatalities or centered around new innovations that could prevent them (. As a defining characteristic, the Vision Zero policy does not start from the supply of possible solutions (thus asking ‘what *can* be done?’), but from the demand articulation for zero deaths (asking then ‘what *should* be done?’). With its use of a mission for dealing with societal problems, Vision Zero is not just considered a new traffic policy, but also as a policy innovation as such (Belin et al., 2012; Belin & Tillgren, 2013).

The use of explicit quantitative goals was not new in Swedish traffic safety policy. Since 1982, goals were established by the Swedish government regarding fatalities in road traffic (Belin et al., 2010). The main policy change of Vision Zero in this regard, was its ethical basis. The ethical principle underlying Vision Zero holds that “*It can never be ethically acceptable that people are killed or seriously injured when moving within the road transport system*” (Tingvall & Haworth, 1999). The policy thus reoriented priorities from preventing accidents in general to preventing accidents resulting in serious injuries or deaths. This also means that investments in traffic safety policy are not evaluated using a cost-benefit analysis, where the return on investment is computed by aggregating all effects using monetary valuations, including the valuation of people’s lives as well as of travel time (which may increase as a result of safety investment).

Two explicit ethical rules in Vision Zero have been highlighted (Tingvall & Haworth, 1999, p. 2). First, “*life and health can never be exchanged for other benefits within the society*”. This principle breaks with cost-benefit analysis that treats traffic fatalities as any other externality as to include the social costs of traffic fatalities in the total of costs and benefits of investments in road infrastructure. As a second rule, it is stated that “*whenever someone is killed or seriously injured, necessary steps must be taken to avoid a similar event*”. This principle ensures that traffic safety policy is a continuous process of learning.

Alongside the ethical approach of the policy the responsibility of the road users and designers of the road systems was changed with three main aspects that differ greatly from other road traffic systems (Tingvall & Haworth, 1999, p. 1):

¹ For further details, see Craens (2019).

- *“The designers of the system are always ultimately responsible for the design, operation and use of the road transport system and thereby responsible for the level of safety within the entire system.*
- *Road users are responsible for following the rules for using the road transport system set by the system designers.*
- *If road users fail to obey these rules due to lack of knowledge, acceptance or ability, or if injuries occur, the ‘system designers’ are required to take necessary further steps to counteract people being killed or seriously injured.”*

The key change here is that the responsibility for safety is not fully centered on the road user, as in traditional road safety systems, but that ‘system designers’ also carry responsibility. System designers are defined as organizations that have responsibilities related to design and maintenance of the elements of the road system (such as vehicles and roads), as well as to the support systems enabling safe road traffic, such as regulation and education (Fahlquist, 2006; Rosencrantz et al., 2007). In particular, they should design traffic systems in such a way that road users’ mistakes do not result in serious or fatal injuries. Hence, this change does not mean that less responsibility is put on road users. Rather, given that road users make mistakes – being human – system designers carry the responsibility to make sure that such mistakes do not lead to major injuries.

This engineering challenge was further elaborated by setting the physical abilities of humans to withstand crash impact central in the design of the traffic system. These factors are taken up in the ability of a vehicle to withstand an accident and the forgivingness of road infrastructure. The combined scientific knowledge on these aspects was used as a starting point for the design of traffic systems, in particular road infrastructure and car design.



Figure 1. Example of 2+1 road in Sweden. From Skvatram (2007).

One example of an innovation that resulted from these principles concerns the ‘2+1 road’ with a barrier which is now a standard design in Sweden on new roads where speeds are over 70km/h (Figure 1). The barrier is erected in the middle of a 2+1 road, which has two lanes in one direction and one in the other direction. This wired barrier prevents head-on collisions between opposing drivers, which often have severe consequences. It is considered extremely effective, lowering fatalities by up to 80 percent (Johansson, 2009). Besides safety improvements, this type of road is also a less expensive alternative for four lane roads, while enabling almost the same traffic flow.

Another practical outcome is the use of roundabouts. Roundabouts are usually not effective in reducing the number of accidents, but ensure that when one occurs, impact is much lower. Because of lower speed levels they can ultimately contribute to a reduced number of fatalities (Belin et al. 2012). Besides these measures, there is attention for improving safety conditions for unprotected road users leading to widespread implementation of separated bike lanes among other measures. Another important focus of improvements is on vehicle design as to address irresponsible driver behavior. One of the innovations is the ‘alcolock’, a device which ensures the driver can only start a vehicle when sober. This solution is especially used with people who are professional drivers such as taxi drivers and bus drivers, or have a history with intoxicated driving (Johansson, 2009). Furthermore, seatbelt reminders have been developed, which provide warnings to drivers when seatbelts are not worn. To stimulate vehicle innovation, the government takes a leading role by procuring cars that are equipped with the most recent safety features. Herewith, it contributes to faster and more widespread diffusion (Belin et al., 2012).

Another distinctive example is the use of so-called ‘safety camera’. These speed cameras are installed on roads which have a high record of injuries or fatalities but lack possibilities to take other measures such as median barriers. To encourage social acceptance of cameras, they were redesigned in the early 2000s, making them round and partly blue, the color used for traffic information. A concurrent campaign was launched on “Sweden’s new lifesavers”. The number of issued speed tickets is confined to a set yearly amount, which practically means that every camera is only operational for ten percent of the time. (Lindberg & Håkansson, 2017). While ticketing is limited the cameras do generate continuous data enabling road operators to learn lessons about effectiveness. These various aspects of camera implementation enabled lowering speeds on large stretches of roads, under high public acceptance levels.

3. Success factors

The Vision Zero policy can be seen as a radically new policy, starting from an ethical rather than from a cost-benefit perspective and introducing a new ‘system engineering’ paradigm which leads to a host of innovations of various kinds. What is more, the policy is radical in its explicit and ambitious mission: zero deaths. This well-defined mission not only directs innovation efforts in a clear direction, but also allows – at least at the general level – for a straightforward evaluation of the effectiveness of policy by measuring the number of fatal accidents every year.

As it is clear from Figure 2, the number of fatal accidents has indeed gone down remarkably. While other countries have managed to bring down the number of traffic deaths as well over this

period, Sweden is ranked among the top countries in the world in terms of traffic safety (Mendoza et al., 2017). Recent data for 2020 show that the country experienced the lowest number of traffic deaths in Europe: Sweden lost 18 lives per million inhabitants against 42 lives per million inhabitants for the European Union on average (European Commission, 2021). From a policy analysis point of view, then, one can ask why the Swedish Vision Zero policy has been such a success (Craens, 2019). Obviously, not all reduction in traffic deaths can be attributed to the Vision Zero policy, as exogenous factors (reduced alcohol consumption) and other policies (innovation from abroad) may also have contributed to the fall in fatalities.

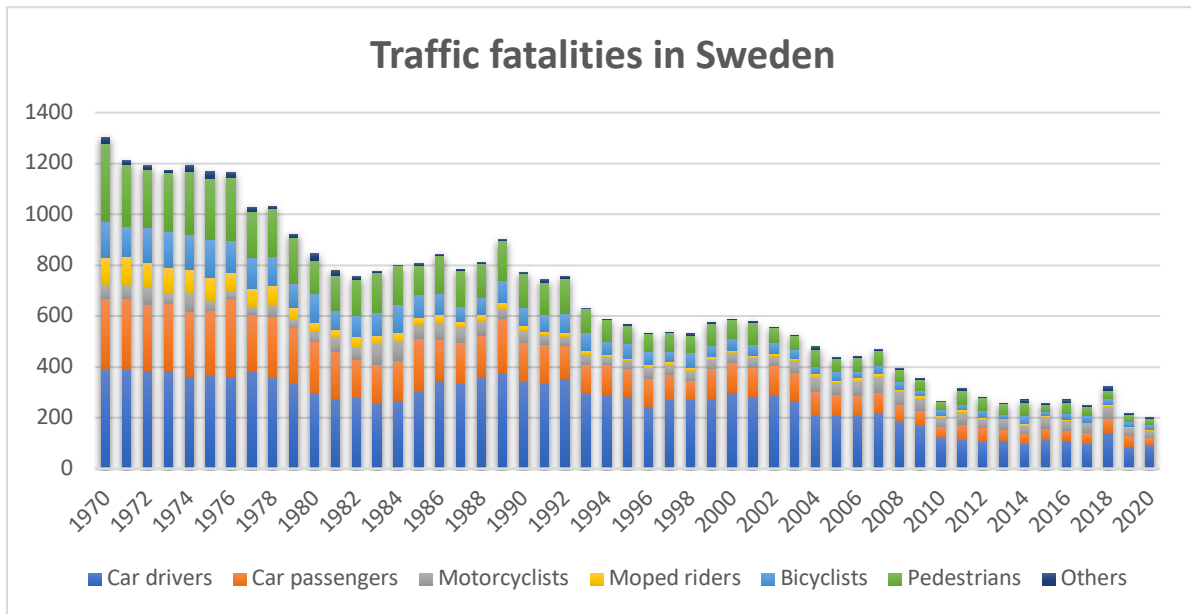


Figure 2. Traffic fatalities in Sweden. From: Transport Analysis and Swedish Transport Agency (2021).

Among the interviewees, the large majority indicated the system design perspective as the most crucial success factor, referring to the design principle that traffic systems should be constructed in such a way that accidents never (or very unlikely) become fatal. Following this principle, many innovations were developed, tested and implemented including the aforementioned 2+1 roads, roundabouts as well as a new speed limit system. What is more, Volvo and Saab intensified their safety innovation programs a few years after Vision Zero started.

The principle of system design was never implemented into legislation meaning the policy was not binding for regional or local governments (Belin & Tillgren, 2013). This means that system designers and municipalities, in principle, could have resisted the Vision Zero principles. The system design was nevertheless widely followed, partly because it was supported by other policy tools such as procurement for innovation and the government body Trafikverket. The main exceptions were some of the rural municipalities, covering areas where people typically drive long distances and value speed and low taxes rather highly at the expense of safety. In these areas, Vision Zero principles were not adopted to the full extent and they were free not to adopt as Vision Zero principles were not codified into binding legislation (Craens, 2019).

A second aspect often mentioned as a success factor was the ethical approach underlying Vision Zero. The argument that any death in traffic is ethically unacceptable is both straightforward and hard to argue against. If one would disagree that any death is unacceptable, an immediate follow-up question is how many deaths one is willing to accept. Providing an exact positive number, then, is much harder than to argue that this number should be zero. This is even harder for a politician, who would have to argue that it is acceptable for a government to ‘kill’ a particular number of people, while at the same time a government is expected to care about its citizens’ wellbeing. Another reason why the ethical basis is compelling relates to people’s personal experience. Most people have experience with traffic deaths or severe injuries in their personal sphere of family and friends. In all, the ethical basis of the policy is considered as a key factor for politicians, experts and the public to accept the new policy. However, it must be noted that the ethical principles underlying Vision Zero are not uncontested (Van Wee, 2011). In particular, as the policy continues, the marginal cost of prevention another traffic death is likely to increase. Given the rising investment to reduce the number of traffic deaths, the policy may become ‘counterproductive’ in terms of overall mortality as an alternative investment may save more lives (Elvik, 1999).

A third aspect relates to learning. Given the long-term goal and wide support for Vision Zero, learning can take place over long periods of time and based on precise data. Policies went hand in hand with scientific research meaning that most measures were only taken if scientific evidence was available, while scientific research projects were, in turn, motivated by questions related to traffic safety. The nation-wide adoption of Vision Zero and the innovation coming out of the policy also help to collect systematic evidence from many sites and for different circumstances.

A fourth success factor is the cooperation between different types of actors. Through intensive cooperation, a wide range of stakeholders is activated to work within the Vision Zero policy. This allows different actors, each with their own expertise and legitimate scope for action, to contribute to the shared goal in a complementary and coordinated manner. Examples of these collaborations include those between the automotive industry and Trafikverket. Knowledge and information about the development of infrastructure and about fatalities is shared, in order to be taken up in developments of new vehicles and infrastructures. As a result, the government policy and innovation strategy of Volvo and Saab became increasingly aligned and complementary. Another successful cooperation is the speed camera project, with a consultancy mediating between private companies and Trafikverket. In addition, cooperation was sought with the police to set up a new approach to ticketing offenders. A final example is the establishment of platforms, such as The Group for National Cooperation for Roads, holding regular meetings among automotive firms, the police, ministries, municipalities and regions.

Finally, some interviewees emphasized the ambition underlying the target of zero deaths. The ambitious nature of the target helped in achieving goals and going beyond actions that would normally be taken. The level of ambition does not only motivate stakeholders involved to reach ever lower number of deaths, but it also creates a continuous pressure from outside as politicians expect improved results year after year.

4. Lessons for mission-oriented innovation policy

Vision Zero marked a paradigm shift in traffic safety policy by taking an ethical principle as starting point and putting system design central. It can be considered a successful policy program as the long-term trend of traffic deaths in Sweden has been going down since, and Sweden currently has the lowest number of traffic deaths per capita across Europe. Obviously, a zero number of deaths has not been achieved – and may never be achieved in the future – but the objective has remained and efforts are ongoing to get closer to this goal. The success of Vision Zero is further exemplified by similar programs being set up in different countries and cities worldwide. Although the exact policy process and implementation differs around the world, similar successes have been reported in bringing down traffic deaths.²

In the context of today's innovation policies oriented towards societal challenges, Vision Zero may serve as one example of how such an innovation policy can be conceived and implemented. In particular, Vision Zero can be understood as an instance of mission-oriented innovation policy *avant la lettre*. The mission character of the policy lies in the articulation of an ambitious and well-defined societal goal with broad support in politics and society at large (Larrue, 2021). Such bold objectives are now also being articulated in other domains, especially in the context of climate change (e.g., carbon neutral maritime transport in 2050) and healthcare (e.g., zero suicides). And, in its implementation, Vision Zero also resonates with the idea that mission-oriented innovation policy is about understanding innovation as 'socio-technical' involving technological, behavioral and regulatory changes (Wanzenböck et al., 2020) and about a broad policy that coordinates several policy instruments, actors and scales in a coherent manner (Larrue, 2021).

While mission-oriented innovation policy has quickly gained in popularity across governments, mostly in the Global North, there is not much consensus yet on how such policies should be designed (Larrue, 2021). Nevertheless, some possible 'failures' have been formulated by policy scholars, that one needs to try to avoid in mission-oriented innovation policy (Weber & Rohrer, 2012; Wanzenböck & Frenken, 2020). We list these in Table 1 and provide an explanation of each. We can then use these possible failures that can be encountered in mission-oriented innovation policy as a way to evaluate the Vision Zero.

If we look back at 25 years of Vision Zero policy through the lens of the four possibly failures, we can conclude from our interviews that this policy has – indeed – been able to avoid most of the failures listed in the table. Handling these challenges has greatly contributed to the success of the policy. Regarding directionality failures, the policy did not only benefit from a clear articulation of a well-defined goal, but also from the wide support among different stakeholders. The underlying ethical principle that any deaths in traffic was seen as societally unacceptable greatly contributed here. To maintain focus and consistency in directionality, the delegation of policy coordination to a specialized agency with sustained funding helped. This agency identified strongly with the policy and actively promoted the vision among stakeholders.

² The success of the Vision Zero policy has not remained unnoticed outside Sweden, and several governments have adopted similar policies including Norway, provinces in Australia, several large cities in the United States and London (Craens, 2019). Moreover, in Sweden Vision Zero style of policy has been developed in other sectors than traffic safety. In particular, challenging issues like fire prevention, suicide prevention and patient safety in hospitals have been subjected to the Vision Zero approach.

Directionality failure	Lack of shared vision regarding the goal and direction of the transformation process; Inability of collective coordination of distributed agents involved in shaping systemic change; Insufficient regulation or standards to guide and consolidate the direction of change; Lack of targeted funding for research, development and demonstration projects and infrastructures to establish acceptable development paths.
Demand articulation failure	Insufficient spaces for anticipating and learning about user needs to enable the uptake of innovations by users; Absence of orienting and stimulating signals from public demand; Lack of demand-articulating competencies.
Policy coordination failure	Lack of multi-level policy coordination across different systemic levels (e.g. regional–national–European or between technological and sectoral systems; Lack of horizontal coordination between research, technology and innovation policies on the one hand and sectoral policies (e.g. transport, energy, agriculture) on the other; Lack of vertical coordination between ministries and implementing agencies leads to a deviation between strategic intentions and operational implementation of policies; No coherence between public policies and private sector institutions; No temporal coordination resulting in mismatches related to the timing of interventions by different actors.
Reflexivity failure	Insufficient ability of the system to monitor, anticipate and involve actors in processes of self-governance; Lack of distributed reflexive arrangements to connect different discursive spheres and provide spaces for experimentation and learning; No adaptive policy portfolios to keep options open and deal with uncertainty.

Table 1. Four typical failures in mission-oriented innovation policy. Adapted from: Weber and Rohracher (2012, p. 1045) and Wanzenböck and Frenken (2020, p. 54)

Demand articulation failures were also properly addressed in the Vision Zero policy. Before the introduction of the policy both automotive manufacturers like Volvo and Trafikverket thought that there would be no market for road safety. With the introduction of Vision Zero, they learnt this was not the case, as Trafikverket actively created and enhanced the market for traffic safety. They did this by using procurement tools and using the government as lead example for taking safety measures. As a consequence, manufacturers introduced more safety features. Furthermore, Trafikverket actively informed end-users on how to behave more safely and use safer equipment in traffic, by using items such as vehicles or helmets. Another example of a measure to stimulate the market for safer vehicles was the EuroNcap crash test program. The Swedish government, jointly with the national governments of the Netherlands and the UK, took a leading role in setting up this European program to test the safety of cars and enhance standards (Hobbs & McDonough, 1998). The resulting crash test scores helped creating further awareness of safety among potential car buyers.

Dealing with policy coordination proved more challenging in the Vision Zero policy. On the one hand, a broad mix of measures to enhance traffic safety was introduced in a generally well-coordinated way. Policy coherence was also addressed as stakeholders were actively flagging policies in other domains that could – unintentionally – worsen traffic safety. More generally, mission-oriented innovation policy is built both on developing new policies to achieve the mission and abandoning existing policies that are counterproductive in reaching the mission. This is in line with the broader idea of transitions studies, that transformations also involve ‘phasing out’ technologies and regulations (Pel, this volume). Yet, the Vision Zero policy also struggled with coordination. While a paradigm shift has taken place in the whole traffic safety sector, the legislation concerning traffic safety has not been adapted to the Vision Zero policy, leaving the concept of system designers without legal framework. The lack of legislation created problems with regard to implementation. Especially at regional levels, this causes problems, since regional authorities have their own responsibility in infrastructure planning. As some of the regions favor speed over safety, some roads still have a high rate of severe and fatal accidents. Trafikverket has few legal measures to increase safety on these roads. Furthermore, coordination between European and national levels of legislation proved difficult. Sweden and Norway are the only countries that have implemented Vision Zero in such a rigorous manner. The development of new national measures is sometimes hampered as implementation of safety regulation is coordinated among countries at the European level. There were also challenges in horizontal coordination between different policy domains. The focus on a single goal, which is common in mission-oriented innovation policy, can lead to trade-offs with other policy areas. While actors involved in Vision Zero acknowledge the importance to coordinate with people involved in other policy domains (such as sustainability, privacy, etc.), concrete actions in this regard are limited. This also limits potential spillovers between the development of technical innovations in these domains (Langeland et al., this volume).

Finally, potential reflexivity failures are well-addressed in the Vision Zero policy. One of the main principles of Vision Zero is a learning attitude. This principle is exemplified in the evidence-based nature of the policy. Proposed improvements are first tested and evaluated before implementation. Insights from industry about quality control and continuous improvement have been translated for the Vision Zero policy. There is an ongoing search for ‘best practice measures’ that can be taken in order to save lives in the traffic system. Yearly follow-up data is retrieved for multiple traffic safety indicators and processed in statistical models as to get insight in the current safety situation. Additionally, platforms which include stakeholders such as the vehicle industry and NGO’s, have been established to discuss developments in traffic safety on a yearly basis.

The more general lessons that can be drawn from Vision Zero regarding mission-oriented innovation policy are threefold (Craens, 2019). For mission-oriented innovation policy to succeed, high-level political support is key. Given that missions can generally not be completed in a few years, such a commitment needs to be rather independent from changing political coalitions in government cabinets, as these tend to change every few years. One way to ensure political commitment is to start from ethical principles that are both straightforward and widely shared. In transportation research, there is now a lively discussion about ethical principles such as equity and sufficiency, which could be drawn upon in developing new missions to address societal challenges related to transport (Van Wee & Geurs, 2011; Verlinghieri & Schwanen,

2020). An example of such a mission would be: in 2050, everyone in the city should have access to all daily necessities within fifteen minutes. As with Vision Zero, various types of innovations, such as new cycling infrastructure or Mobility as a Service (MaaS) technologies could be combined to achieve the mission. A second way to ensure commitment to the mission-oriented innovation policy, is to anchor parts of the policy in strict targets (such as the Paris agreement of CO₂ reduction in Europe), which can be translated into binding laws. Indeed, the Vision Zero case suggests that the policy could have been even more effective if principles were codified in legislation rather than dependent on voluntary adoption of lower governmental levels. In the context of climate change missions can be developed that combine a legal CO₂ reduction target with ethical principles such as equity. For example: all citizens should have access to affordable, zero-emission mobility in 2040.

A second key lesson that can be drawn from Vision Zero is the ability to measure progress along the way, and to attribute success and failure to particular measures. This allows stakeholders to evaluate progress on a regular basis and also be adaptive in what policies and innovations to use. Collective learning is supported by a shared evidence base produced by an independent body. It should be noted that an evidence-based approach is highly established in transportation research and policy. Traffic measures are routinely evaluated by collecting large amounts of data on traffic participants. In policy fields such as transportation and healthcare, which have a longer tradition of evidence-based policy making, the learning component of mission-oriented innovation policy may be easier to implement. On the flipside, a challenge of current evidence-based approaches is measuring progress in terms of deeper-level institutional change (for example in terms of culture) (Pel, this volume). In addition, these types of changes can be important for achieving missions. A potential solution might be a more open strategy of evaluation which is sensitive to different types of impacts (including social impacts) and unintended effects. For example, early electric vehicle users joined online communities, which then influenced the development of new driving and charging habits (Meelen et al., 2019). For mission-oriented innovation policies, learnings about such unexpected effects could be applied in subsequent rounds of innovation experiments.

Finally, in terms of impacts, while mission-oriented innovation policy is motivated by societal challenges, it may also contribute to more classic economic objectives of innovation policy such as job creation or economic competitiveness. By actively sharing the vision with a broad range of actors, including industry, new products can be developed and new markets can be created. In this respect, governments can use public procurement for innovation, promote standard-setting, introduce clear regulations and support university-industry collaboration to help make local firms more innovative. An ambitious policy at national or regional levels can thus create a 'testbed' for all kinds of innovations that may later on be exported in global markets. A recent example of this is the Norwegian strategy for reduced shipping emissions, which went hand-in-hand with the development of local industrial capabilities to produce electric ferries (Bugge et al., 2021). Yet, economic objectives should not be considered as a key objective of mission-oriented innovation policy, as the primary goal of mission-oriented innovation policy is to tackle a persistent societal problem, which traditional policies have failed to solve.

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