

***Mission-Oriented Innovation Policy and Societal Challenges:  
Lessons from the Swedish Vision Zero Program***

**Jannes Craens**

Student Number: 6258034

j.a.craens@students.uu.nl

2018-2019

GEO4-2239X IS-Master's thesis

MSc Innovation Sciences, Utrecht University

Supervisor: Prof. Koen Frenken



## Summary

Increased population, mass consumption and unsustainable production have led to grand societal challenges such as climate change and obesity. These problems are not easily solved as they are nested in society and wicked in nature. An effective approach would necessitate a diverse set of actors working together with long-term commitments. Societal challenges have sparked into renewed interest for Mission-Oriented Innovation Policy (MIP) with policy makers. In the past, missions were limited to technological projects with an aim to accelerate innovation. Recently, MIP has been redeveloped to suit more in a transformative societal context where societal missions are taken as starting point.

Until now, however, there are very few practical examples of MIP in societal context. This thesis investigates one such example from Sweden, where a diverse set of actors started an ambitious program in 1997 to substantially reduce the number of traffic-related deaths, called 'Vision Zero'. The guiding question of this thesis holds what can be learnt from the Swedish Vision Zero program for Mission-Oriented Innovation Policy.

We find that that the key factors underlying the successful Vision Zero program in Sweden are: the systems perspective, an ethical mission formulation, continuous learning combined from best practices, and broad cooperation across stakeholders on different levels. We also find that it may be difficult to transfer the policy to other national or sectoral contexts. We end by listing a number of conditions that make the use of a Vision Zero logic in the context of MIP suitable.

## Content

1. Introduction .....	5
2. Mission-Oriented Innovation Policy.....	10
3. Methods.....	18
4. What is Vision Zero? .....	22
5. Success factors of Vision Zero.....	29
5.1 Attributes from the coding framework.....	41
5.1.1 Success factors from the coding framework.....	41
5.2 Contextual factors of Vision Zero.....	50
5.2.1 Positive contextual factors.....	51
5.2.2 Negative contextual factors .....	54
5.3 Conclusion.....	57
6. Vision Zero in the light of the Weber-Rohracher framework.....	60
7. Vision Zero Transfer .....	73
7.1 Vision Zero in other geographical sectors.....	73
7.2 Vision Zero in other sectoral sectors .....	80
8. Discussion.....	88
9. Conclusion.....	90
Bibliography .....	94
Appendix A. List of interviewees.....	99
Appendix B. Interview guide.....	100

## 1. Introduction

With an expanding population, higher living standards and globalization new problems are emerging in society (Kaplinsky, 2014). Numerous developments in society are causing problems for people regarding health or safety. So is environmental pollution an ever-growing problem by the lock in of the fossil fuels-based regime. Moreover are health problems such as obesity growing (Boden, Cagnin, Carabias, Haegeman, & Könnölä, 2010). These 'Grand Challenges' are not just problems common to societies in developed countries, but also to societies in developing countries (Metz, Meyer, & Bosch, 2007).

Grand societal challenges also differ from other policy problems in that they are highly wicked (Rittel & Webber, 2013). The wickedness stems both from political contestation and limited understand of causes and effective remedies. Therefore, to take up these challenges, large efforts from a wide range of stakeholders is required, enlarging the political basis for solutions and combing expertise from different actors.

To tackle societal challenges, the need for technological innovation is often highlighted (Mazzucato, 2016)(Mazzucato, 2018) (Schot & Steinmueller, 2018) (Fagerberg, 2018). As a result, government policies addressing societal challenges have increasingly been subsumed under innovation policy. In the past, multiple innovation theories have been providing the basis for innovation policy by governments. One of these policies is the market failure approach. This starts from the idea that firms under-invest in R&D, as they are afraid that their knowledge and ideas spillover to competing firms (Arrow, 1962). The main aim of innovation policy, then, is to encourage companies to invest more in research and development through subsidies in order to boost the commercialization of inventions. With this policy national growth can be increased and unemployment be lowered. Another policy aimed at boosting the economy was developed after the market failure policy and is based on the concept of system failures. This policy is based upon the innovation systems approach (Freeman, 1988) (Lundvall, 1992). With this policy a well-functioning innovation system should be built to create optimal actor inclusion and

proper knowledge sharing between them. The systems should subsequently be formed around a technological or geographic area to produce the ideal environment and lead to higher economic output.

Market-failure and system-failure innovation policies were found to fall short in solving societal challenges (Weber & Rohracher, 2012). The foremost reason is that both the market failure approach and systems approach lack the ability to properly engage in societal problems. As their main purpose is to create economic growth, these policies are undirected in solving particular challenges. One may even argue that economic growth is one of the main causes underlying the societal challenges that we face, such as climate change and obesity (Alkemade, Hekkert, & Negro, 2011). Besides this notion the problem also arises that there is no market for solving societal problems because there are no immediate financial gains to be made, and hence the two policies do not provide incentives to solve these.

These are however not the only reasons that the two innovation policies do not fit with modern problems. Both theories lack a direction of policy which makes it difficult to reach certain desired goals. Because market failure approach addresses only a certain area of interest that can be stimulated with R&D, it remains highly uncertain that desired outcomes will be met. Furthermore, the inclusive character of the systems approach can sometimes bring negative outcomes because parties that have been causing a problem, are nevertheless included in the system (Frenken, 2017).

Solutions for these problems are taken in a new form of policy, Mission-Oriented Innovation Policy (MIP). MIP is adapted since the late 2000s to take on large, wicked societal problems. MIP is a further development of the old mission driven government programs, such as the Apollo program of NASA in the United States or the TGV program by the SNCF in France. Back in the 1960-s and 1970-s it was exclusively used for technical missions, which is the largest difference with the current theory that is aimed at societal challenges. This can also be perceived as a difference as an accelerator mission in the old style and a transformative mission

regarding new social problems (Arjen Goetheer, 2018). Multiple scholars have since then engaged in the development of MIP. Scholars such as Mazzucato (Mazzucato, 2016)(Mazzucato, 2018), Frenken (Frenken, 2017), Schot and Steinmuller (Schot & Steinmueller, 2018) and Fagerberg (Fagerberg, 2018) have made contributions to the literature and are further explained in chapter two. These papers are however not in accordance with each other and the authors bring forth different key points. These differences show that MIP is far from being crystallized and cannot be used as a common policy tool, at this moment.

This demonstrates that there still is a need to further develop MIP and look at successful examples of the policy. One of these examples is the successful Swedish Vision Zero Policy. This revolutionary policy was introduced in 1996 with the aim to reduce the amount of traffic related fatalities and severe injuries to zero (Riksdag, 1996). Not only was the approach in terms of using an ethical approach in traffic safety new, also the used form of policy, by using a mission to reach a certain social goal is considered an innovation in the field of a social problem. The proposal was politically wide supported and a large coalition of actors was formed to work on the problem. The outcome of the policy has since then showed to be successful as Sweden has one the lowest amount of traffic related fatalities in the world with 25.3 traffic related fatalities in 2017 per one million inhabitants (Vägtrafikskador, 2018). Since results of a far-reaching policy need time to manifest in positive results, many scholars only picked up Vision Zero in the last decade when it was showing positive results. Moreover, until now no research in the area has been performed of innovation policy on Vision Zero.

The aim of this thesis is to translate the successful policy from Vision Zero to MIP. By doing this the research contributes both to the theoretical framework of MIP and to the implementation of missions. The conceptualization of MIP can be strengthened by looking at the state-of-the-art understanding of MIP and comparing the Vision Zero case to frameworks underlying MIP. This results in a critical assessment of the theory, used to improve the frameworks underlying MIP by learning from the success of Vision Zero. As a second outcome, we look at attempts to copy the policy to other sectoral contexts, as to see how generic the policy can be in solving

societal challenges. From this, we can distill a list of conditions that make the use of a Vision Zero logic in the context of MIP suitable.

The overarching research question is:

***How can Mission-Oriented Innovation Policy be improved learning from the Swedish Vision Zero program?***

The main research question can be further sub-divided into several sub-questions. The first sub-question explains on a broad way what Vision Zero entails and what the fundamentals of the policy are. Furthermore, the policy design and mix of measures will be explained, also a description of how other countries and sectors have used Vision Zero to get a better understanding how it can be used and what kind of underlying factors are influencing Vision Zero type policies in mission development and implementation.

**1. What entails Vision Zero?**

The next sub-question elaborates which factors contributed to the success of Vision Zero, to come with a list of critical success factors pointing to critical conditions.

**2. What contributed to the success of Vision Zero?**

The article of Weber and Rohracher (2012) is considered one of the seminal articles in transformative change for social context. Their main contribution was to add transformational system failures to the classic system failures. Confronting the key success factors of Vision Zero program with their list of failures that can occur in a transformation in social context, can validate their framework as well as point to omissions in their framework.



**3. *How do success factor of the Vision Zero program match with the failures framework developed by Weber and Rohracher?***

The last sub-question relates to the transferability of the Vision Zero policy to Mission-oriented innovation policy. Especially what kind of conditions are needed to use Vision Zero successfully looked at Mission oriented policy. Preceding sub-question can provide input to conclude on this question

**4. *Under what conditions can Vision Zero theory be used for Mission-oriented innovation policy?***

Before these sub-questions will be answered, we will first discuss various frameworks on mission-oriented innovation policy in chapter 2 and our methods in chapter 3. When then answer the four sub-questions in chapter 4 to 7, and end with a discussion in chapter 8 and conclusions in chapter 9.

## 2. Mission-Oriented Innovation Policy

Mission-Oriented Innovation Policy is currently making a revival since it was first used in the 1960s (Mazzucato, 2016) (Schot & Steinmueller, 2018). This revival is happening because of the promising outlook MIP has on addressing Grand Challenges and societal problems. The use of missions in the realm of innovation policies goes back a long time. Already in the 1940-s and 1950-s this logic was used (Kemp, 2011). The main area of application was in large governmental bodies of the United States of America and France. Large organizations such as the Department of Defense and NASA used missions to realize large technical projects. Stemming from the Cold war, pressure was prevalent to focus on technical missions in certain areas such as the Apollo space program (Mazzucato, 2013). With the moon-mission, a well-articulated mission and clear technical goals were set and actors that could contribute to the goal were assembled to accelerate the technical mission. Another interesting aspect is that not only high-tech sectors were involved but also low-tech sectors such as clothing contributed towards the mission (Mazzucato, 2016). In France, the most well-known technical mission was high speed inter-city transportation, which led to the successful TGV network.

Missions got out of fashion, as market-failure thinking became dominant. Innovation policy based on market failures has as its main purpose to stimulate economic growth. It starts from the idea that firms underinvest in R&D since they expect that their competitors will also benefit from the new knowledge they create, without being compensated for it. The goal of market failure policy, then, is to stimulate innovation by firms. Policy instruments like subsidies and tax exemption schemes are examples of this (Frenken, 2017). However, recently, it was found that subsidies on R&D are not as effective as promised in increasing R&D spending in companies (Gaillard, Ladinska & Straathof, 2015).

Four aspects of innovation were found that go against the logic of market failure as a rationale for innovation policy (Schot & Steinmueller, 2018). First, knowledge was found to contain tacit elements and is therefore not able to spread freely around the globe, this is called the

stickiness of knowledge as it geographically bounded (Von Hippel et al., 1993). Secondly the ability to absorb new knowledge depends on the amount of absorptive capacity an entity has from a starting point (Cohen & Levinthal, 1989). This means that an actor needs to have a certain degree of knowledge and capabilities to start with in order to further develop and absorb new knowledge. Third, a lack of absorptive capabilities were not only found to hamper the diffusion of knowledge but were also important on the course of the social capabilities and the social ability of entrepreneurship. This implies that people are willing to start new businesses and embrace the risk accompanied with it. Finally, the cumulative and path dependent nature of knowledge development was emphasized. This showed that when a radical innovation was introduced it usually follows an incremental trajectory to further improve and thus often creates a certain gradual pathway of development and sometimes lock-in (Arthur, 1983).

These ideas showed that it was not only important to commercialize inventions but also to increase the amount of learning and knowledge shared between actors. Since this was the difference in the capacity to innovate and accommodate the process of learning. From these aspects systems thinking was introduced with the National Innovation System (NIS) (Freeman, 1988) (Lundvall, 1992). In this theory it is stated that an arrangement of actors and institutions and the relations they have with each other determine how innovative they are. Thus, the NIS framework aims to optimize this by arranging the system on such a way that the capacity to innovate is improved and ultimately creates economic growth. At first this was only focused on a national level but later became adapted to suit more widespread approaches such as regions and sectors. The systems approach was later further adapted to not only be bound to geographical entities but also to technologies, called Technological Innovation Systems (TIS). In this approach the focus is on the development and diffusion of a specific technology and the arrangement of the system around it (Edquist, 1997) (Hekkert, Suurs, Negro, Kuhlmann, & Smits, 2007) (Bergek et al., 2007).

However, in recent years the system approach has also been subjected to critique. System failures such as underdeveloped actors or linkages in the system are prevalent. Besides these failures also the inclusive factor is doubtful. Considering social challenges, it could be better if entities that resist transformation are not included. Their interest is often the continuation of the status quo (“lock-in”), and hence, should be excluded from the system to speed up the transformation. Moreover, the theory is considered too static to fully explain the dynamics of innovation. The static nature of the theory is derived from the many historical case studies it is based upon, while institutions and technologies co-evolve which makes it difficult for the system approach to dynamically engage in solving failures. With the rise of Grand Challenges, such as issues with climate change, obesity and traffic safety are becoming a greater problem in the world and receive therefore more attention. Events as the Horizon 2020 program and the United Nations 17 sustainable development goals are examples of these (Owen, Macnaghten, & Stilgoe, 2012). The problem however is that old innovation policies such as the linear way of conducting innovation or a systemic approach are not capable to handle these societal problems well (Weber & Rohracher, 2012) (Frenken, 2017) (Fagerberg, 2018) (Schot & Steinmueller, 2018).

Both market-failure and system-failure policies aim primarily to stimulate economic growth and job creation. Yet, a lot of negative externalities have occurred in the last decades through economic growth as described above (Steffen et al., 2015) (Meadows, Randers, & Randers, 2012). These negative externalities are neglected in the first two approaches there is no set direction to a certain social goal. This can result in negative externalities such as the current fossil fuel-based regime and mass consumption and production. To curb these negative externalities a new revival in mission-oriented innovation policy (MIP) was introduced that included societal missions (Foray, Mowery, & Nelson, 2012). These missions provide longer time frames and have a societal goal in solving a particular persistent problem. It also differs from past technical missions in its focus on diffusion of technology, the coordination of the multitude of stakeholders involved in the innovation, and a diversity of funding and investments sources. Finally, MIP often must overcome established industrial structures

dominated by incumbents with which new solutions have to compete. In all these dimensions, the modern MIP differs from the old mission approaches, which were mostly technical of nature and stemmed from political ambitions to accelerate technical development. In table 1 an overview can be seen of the innovation approaches discussed.

Aspect / Policy	Mission-oriented old style	Market failure approach	Systems failure approach	Modern mission-oriented approach
<b>Goal</b>	Develop technical solutions for governmental bodies	Commercialize inventions for the benefits of economic growth	Enhance knowledge sharing to increase economic growth	Solve societal problems
<b>Time</b>	1950-now (but peaked during 1950-1970)	1960-now	1980-now	2010-now
<b>Policy measure</b>	Clear goal articulation within time limits risk averse long-term commitment	Stimulate basic research and R&D within companies	Improve knowledge flows between actors and focus on cooperation and knowledge sharing	Create well-articulated missions for societal problems with an inclusive coalition that want to solve this problem. Unlocking MFA and System approach to adapt these in order to suit the MIP
<b>Key actors</b>	Governments and Large firms	All firms conducting R&D	Firms, Universities, knowledge institutes and Governmental bodies	Firms, Universities, Knowledge institutes, governmental bodies, users, citizens, citizen organisations, NGO's and start-ups

Table 1 An overview of innovation theories

From these beforementioned publications, different streams of literature have emerged that use mission-oriented innovation for a certain target. One of the seminal works was produced by Weber and Rohracher (Weber & Rohracher, 2012). They observed the increased attention of societal challenges and made a critical analysis of related approaches to sustainability transitions such as the aforementioned TIS and the Multi-Level Perspective (MLP). They describe that TIS has multiple shortcomings to deal with transformative change in society and is not very useful to deal with societal changes, as it mostly focuses on the emergence phase of technology. They however find that the Multi-Level perspective (MLP) framework – which understands transitions from niches breaking through an existing regime supported by global

landscape factors – brings several insights in dealing with transformative challenges. Firstly, they agree with MLP in its a clear goal-orientation regarding system transformation. Secondly, they state the MLP also deals with the demand side of innovation and thus takes production of goods and consumption in consideration, while TIS does not pay much attention to demand. Thirdly, the point is made that MLP is better equipped on coordination between research, technology and innovation policy because MLP has a better focus on transformative change. The last argument is made for the long-term reflexivity of the MLP to better suit long-term transformational paths (Weber & Rohracher, 2012)

Policy	Type of failure
Market failure	Information asymmetries Knowledge spill-over Externalization of costs Over-exploitation of commons
Structural system failures	Infrastructural failure Institutional failure Interaction or network failure Capabilities failure
Transformational system failures	Directionality failure Demand articulation failure Policy coordination failure Reflexivity failure

*Table 2 Twelve failures of Weber & Rohracher (2012)*

These arguments inform a new set of what Weber and Rohracher (2012) call ‘transformational system failures’, which complement the market and structural system failures, as in table 2. While these failures provide both a rationale and pointers for mission-oriented innovation policy, mission-oriented innovation policy as such is not emphasized in their paper. Rather, their contribution lies more in the critique that systems thinking is underequipped for transformative change, which motivates the list of additional transformational system failures to back up this argument. Moreover, the authors vouch for a new type of framework that is still based upon systems thinking, while having the breadth of the MLP framework. The provided framework of twelve failures in transformative context takes in account a longer time span, the demand side of innovation, institutional settings beyond research, technology and innovation, and reflexive mechanisms to ensure a long-term commitment and learning.

Mariana Mazzucato is considered one of the most known scholars about MIP as she merged the ideas of MIP policy and the concepts of transformation failures. She focuses primarily on state-

led mission that are better in providing long term funding than firms, and therefore are better at embracing risks which finally result in better commercialization and diffusion. The first works of Mazzucato that concern MIP have an economic nature and mainly use the MIP for the benefit of economic growth (Mazzucato, 2013) (Lazonick & Mazzucato, 2013) (Hammersley, 2009). The incentive for this policy is the change in economic competitiveness in the world wherein Europe is losing its leading position. In her later works Mazzucato's view on MIP is adapted to be more able in dealing with Grand Challenges and therefore takes a more societal stance in using the policy (Mazzucato, 2016)(Mazzucato, 2018)(European Commission, 2018). In these publications she proposes four critical measures when dealing with MIP frameworks. First, the direction of change should be promoted by policy, which she calls directionality similar to Weber and Rohracher. Second, the nature of organizations included in the MIP should embrace the underlying risks of the discovery process. This process should enable the long-term nature of visions. Third, the policies should be evaluated and adapted when needed. Moreover, this monitoring process should be better suited in dealing with risks and more long-term project engagements, which current policies fail to do. Fourth, risks and rewards should be shared in order to create a more inclusive model for growth. While her later work have more societal direction, the policy can however still be considered more aimed towards improving the economy than solving societal problems.

A different approach is taken by Frenken (2017) who critiques Mazzucato. His main point is that a strong emphasis on the state runs the risk of policy being captured by vested interests of incumbent firms dominating innovation systems and innovation-policy making. To deal with societal challenges, he advocates a bottom-up and diversified approach. By doing this a strong and diverse actor network can be set up and the role of the government is less than in Mazzucato's works who in his view is too strongly affiliated with large firms and incumbents to engage in MIP. When a central role for the government is allocated and an undiversified strategy is chosen, large companies will represent a significant part of the available 'product space' and therefore also determine a large part of the direction innovation is taking place.

Schot and Steinmuller (2018) mention, as the previous authors, that previous innovation policies based on market failure and system failure are not up to task to deal with Grand Challenges and transformative change. They however state that these theories should not be abandoned. In their view the frames of market failure and innovation systems should be harnessed under the mission-oriented approach to tackle societal challenges and transformations. Another point of interest is the argument they make that MIP is more suitable for the global south as this policy has a broader range of applications. This can be said because both market and innovation system policies assume that a certain knowledge base is present to depart from. By using MIP this is much less the case, as countries would not have to catch up in order to fully utilize the capabilities of the policy (Schot & Steinmueller, 2018).

Fagerberg (2018) has mainly critique on the article of Schot and Steinmuller (2018) in the article 'Mobilizing innovation for sustainability transitions: A comment on transformative innovation policy'. He states that Schot and Steinmuller neglect the role of firms in transformative context, while these entities form a large part of the society. He states that the accumulated innovation policy research should be analyzed to help in the development of practical policies for MIP. Therefore, he makes the point to further build upon the current knowledge base. With this notion he departs to make a more specific MIP framing including the role of firms, in five recommendations. The first recommendation is the direction setting of the mission. Secondly, he states that opportunity should be embraced, by using mission-Oriented innovation policy a less averse environment should be present for taking risks. Thirdly, the mobilizing aspects are addressed, with MIP this should be more inclusive in the form of a broader array of stakeholders and especially users of the innovation. Fourth, recommendations he states a holistic policy making by better combining the supply and demand sides regarding policies orientation. At last the governance should be changed to better suit the new activities that MIP brings forth. This implies that the policy should not interfere with each other and that the policy is monitored and adapted on a reoccurring basis in order to suit the needs of the transition (Fagerberg, 2018).



This summary of several MIP works shows that there is no defined MIP theory and many aspects and factors concerning the approach differ. What they however all have in common is that these scholars want to address that a certain direction of innovation is needed. To solve Grand Challenges, social policy should be integrated in innovation policy which can be done with the forming of missions. Besides provides a mission often a longer and broader view thus helping the diffusion of the innovation and dealing with risks and uncertainties a long-term commitment brings forth. These aspects, and especially directionally, connect very well with the case of Vision Zero. The goal of zero traffic fatalities that Vision Zero has is a good example of this. Moreover, the long-term vision is guaranteed because bringing down the traffic fatalities to zero is a long process that requires time and innovations.

For this thesis these concepts are important to understand how a MIP should look like. There is still a lot to be discovered in setting a final MIP framework, especially on what way the theory should be practically connected remains uncontested. Combined the most recent developments with Vision Zero the theory on MIP can further be strengthened and observed what it means in generalized theory.

### 3. Methods

For this thesis the goal is to bring the approach of Vision Zero and the background of MIP together and to see what can be learnt from the Vision Zero approach. To perform this thesis abductive grounded research approach is chosen. The Abductive approach suits best with this thesis because of the nature of Vision Zero and MIP. An inductive approach is not suitable for this research since only one case is used to improve the MIP framework and therefore no significantly tested patterns can be unlocked. Moreover, it would also be too complex to fit into the boundaries of this thesis. Deductive reasoning for this research also doesn't fit, as there is no hypothesis that should be confirmed or rejected. The purpose of this research is learning from Vision Zero and not to test it, because there is no MIP framework yet. An oversight of the different research approached can be found in Box 1. By using abductive reasoning and combining the successful aspects that the case of Vision Zero have and the background of MIP a new best prediction can be made upon the combination of this case and policy. (Reichertz, 1995).

**Abductivism:** Main purpose to uncover surprising facts or puzzles. The goal is to fit a most likely and 'best' explanation to these puzzles using both numerical and cognitive reasoning can be used to solve the puzzles. Used both for quantitative and qualitative research.

**Deductivism:** Main purpose is to test established theory on new data. Thereby setting a hypothesis upfront that is thought to be confirmed or rejected. Used for quantitative research and deductive qualitative research

**Inductivism:** Main purpose is to gather new theory derived from data. On this way generalizable inferences can be made from the observations. Used for qualitative research, in particular grounded theory, and big data/quantitative analysis

*Box 1 Three types of research approach (Saunders, Lewis, & Thornhill, 2012)*

This thesis uses a mixed methods design for data collection. Firstly, two streams of literature can be distinguished. Literature of MIP was collected and researched to see what the current state of the art is considering this research area. Secondly, literature on Vision Zero was analyzed. This is needed to explore the trajectory Vision Zero went through and which factors contributed towards the success of the policy. Concerning Vision Zero literature, publications were searched for the explanation of the policy and the history of the policy and the adaptations

that were made over time. All interesting reports that contain information about MIP related themes were considered as they are of academic nature or actors that have proved to be authorities in the field. The same can be said for Vision Zero literature regarding MIP theory, the most recent works were reviewed and deemed most important as this thesis will contribute to literature, which only can be done with the state-of-the-art literature in mind.

As a second source interviews were conducted with important actors of Vision Zero in Sweden. By interviewing these people in person and asking questions over the innovative aspects new information can be discovered.

In the context of this research an important actor is a person who has published about Vision Zero, favorable in the area's such as policy implications or explaining success factors of the program. Besides that, are actors that are professionally related to Vision Zero useful for gathering data. So are people that work at Trafikverket, the Swedish Ministry of transport, that is responsible for Vision Zero in Sweden, or other related organizations of interest to be interviewed. Also considered are actors that are involved in other types of Vision Zero policy than Traffic, such as Volvo's own mission zero or Vision Zero type policy that is implemented in other sectors. This is done to include multiple views that include both internal and external views of the policy and consider development over time.

The sampling strategy that was used for the interviews was contained both a purposive nature and snowball theory. Meaning that the people that were interviewed were chosen partly based upon their geographical location in Sweden and their role in the policy. Important actors in the Vision Zero program, both in a historical sense and in current developments of the policy were geographically mapped. When this was done, a critical assessment took place to see in which area the most, diverse and important actors were located. This resulted in the city of Borlänge, where Trafikverket is located. The geographical mapping is chosen because the time in Sweden was limited and Sweden is geographically a large country. Therefore, the location of some actors could be too distant from the interviewer's location. That is the reason why is

chosen to first pick actors nearby the interviewer's location to make sure that a decent number of interviews can be held. Further was snowball sampling used with the purposively approach to hold interviews to reach more people that had a connection to Vision Zero.

In total fourteen interviews were conducted for this Thesis wherein a distinction of four groups of people can be distinguished. The first and largest is the group of employees at Trafikverket, the governmental body that works on Swedish road traffic infrastructure and safety. Most people interviewed at Trafikverket hold a position that have relations with policy making and the articulation of the policy towards other parties in the way of collaborations for example. The second group consist out of two scholars, these interviewees are professionally engaged with conducting research on universities and have a mayor research topic in Vision Zero. Furthermore, there were three interviewees that have occupations in private firms that have connections with Vision Zero. At last there is a group of three people that are also working with the Vision Zero policy at the Swedish government, but not at Trafikverket, a complete list of the interviewees can be seen in appendix A.

For the interviews a semi-structured approach is chosen because they have a clear, pre-determined focus. However, there is some elasticity in how the questions are asked and they allow for open-ended discussions of the answers (Kane & Brún, 2001). In this way, they allow for the pursuit of unexpected lines of enquiry during the interview (Grix, 2010). Semi-structured interviews enable the subject to be investigated in depth while allowing some freedom to ask further questions "in response to what are seen as significant replies" (Bryman & Bell, 2018). The interview guide used for this thesis can be seen in appendix B.

The interviews where centered around Mission-Oriented innovation policy, the link between the policy and the practical implementation of the policy. It is especially promising how Vision Zero has successfully used the innovation system that has spurred successful road safety innovations. An important factor that was considered during the interviews is recall bias, because Vision Zero currently is a successful policy and receives many positive recognitions.

This has however not always been the case, in the beginning several actors opposed and a period of ten years was needed to show results of the policy (Rosencrantz, Edvardsson, & Hansson, 2007). Solution for recall bias can be made twofold. The interviewees can be blinded to the study hypothesis in order to minimize the recall bias. This can help because subjects are less moved towards a certain direction upfront and therefore remain more neutral. Besides was the gathered data verified by the interview via proxy sources to triangulate the results obtained through the interviews, such as articles published in journals or papers. Also other sources that contain information such as Government laws or television programs (Hassan, 2005).

Open coding was used to gather concepts and information from the interviews. After open coding axial coding was used. During the coding process a bottom-up, in vivo approach was used to stay as close to the data and to generate a list of concepts. The concepts were subsequently developed into overarching categories. The gathered concepts and categories were confronted to the list of failures made in transformative context (table 2). This list was introduced by Weber and Rohrer, to deal with failures that can occur when aimed for transformative problems (Weber & Rohrer, 2012). Using the framework, a structured way of positive and negative aspects can be gathered in transformative context from the interviewees.

In this study all data is gathered firsthand by the researcher. The data should be considered to be of sound quality, given the restrictions imposed during the sample development and data collection. The sampling strategy, concept definitions, operationalization, treatment of the data and analysis techniques used are all clearly described in this paper, rendering the study to be repeatable by interested parties.

Validity refers to the 'generalizability' of the research. Since this study uses the perspectives of Innovation scientists and Traffic safety experts the results should only be generalized to these sectors, however it could very well give insight into what could be expected to happen in other societal problems and Grand Challenges.

#### 4. What is Vision Zero?

Vision Zero is a traffic safety policy introduced by the Swedish government in 1997 (Riksdag, 1996). The policy states that there should be zero traffic deaths or severe injuries in the future in Sweden. While a certain time span is not provided to reach the goal of zero, the vision was introduced with a long-time span in mind (M. Å. Belin, Tillgren, & Vedung, 2012). This policy differs from normal traffic policies, in a way ambitiously aims to bring fatalities to zero and that it incorporates a long-time span (Johansson, 2009). Before Vision Zero, traffic safety policies were built around reducing fatalities or centered around new innovations that could prevent them (Amalberti, 2001). Vision Zero has resulted in the paradigm shift from the old question of 'what can be done?' to the question 'What must be done in order to create a safer road transport system?'. In this sense, policy does not start from the supply of possible solutions (what can be done), but from a societal demand (zero deaths). By using 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 (M.-åke Belin & Tillgren, 2013) (M. Å. Belin et al., 2012).

The idea to introduce the Vision Zero policy stems from individual actors such as Claes Tingvall, also coined the 'father of Vision Zero' by many interviewees, and others who got the inspiration for Vision Zero from the medical sector where there is no acceptable loss in life quality systems. In medicine all measures taken on the most recent developments in science, which was thought to also have a good fit in traffic safety. When the plans were developed, Claes Tingvall got in contact with the then minister for communications Ines Uussmann. She liked the idea and made efforts to ensure a broad political backing, which it got since the policy was supported by all politicians in the parliament when it passed in 1996 (M. Å. Belin et al., 2012).

As a second origin of Vision Zero, the history of road traffic safety in Sweden is relevant. Already since 1971 there were plans to introduce quantified fatality goals, and since 1982 there have been quantified goals established in Sweden on the number of road traffic related fatalities (M.-Å. Belin, Tillgren, & Vedung, 2011).

Comparing Vision Zero to normal traffic safety policies the most observable difference can be seen in ethical grounds. The ethical perspective in this policy means that it can never be acceptable that people are killed or seriously injured when moving within the road transport system (Riksdag, 1996) (Fahlquist, 2006). With Vision Zero, accidents which result in no injuries are only seen as a 'cost' and therefore have a lower priority as ones that are fatal or result in serious injuries. 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 (M.-Å. Belin et al., 2011).

1. 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.
2. Road users are responsible for following the rules for using the road transport system set by the system designers.
3. 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.

With the vision that mobility is a function of safety, the responsibility is not fully centered around the road user, as in traditional road safety systems. Extra responsibility is added for the 'system designers' which are organizations, firms or people that have occupations that are related to the road system (Fahlquist, 2006)

1. Vulnerable road users should not be exposed to motorized vehicles at speeds exceeding 30 km/h.
2. If 1. cannot be satisfied then separate or reduce the vehicle speed to 30 km/h.
3. Car occupants should not be exposed to other motorized vehicles at speeds exceeding 50 km/h in 90 crossings.
4. If 3. cannot be satisfied then separate, or reduce the angle, or reduce the speed to 50 km/h.
5. Car occupants should not be exposed to oncoming traffic (other vehicles of approximately same weight) at speeds exceeding 70 km/h or 50 km/h if oncoming vehicles are of considerably different weight).
6. If 5. cannot be satisfied then separate, homogenize weights or reduce speeds to 70 (50) km/h.
7. Car occupants should not be exposed to the roadside at speeds exceeding 70 km/h, or 50 km/h if the roadside contains trees or other narrow objects.
8. If 7. cannot be satisfied separate or reduce speed to 70 (50) km/h.

*Box 2 Speed limit system of Vision Zero*

(Rosencrantz et al., 2007). They

should design and produce their work in such a way that it is not possible that a fatality or serious injury can happen when the road user makes a mistake being in traffic. Therefore, this change does not mean that less responsibility is placed on the road user, they should take all the measures to act according to the set rules and guidelines as in every other traffic system, as stated by interviewees C, E and N.

This aspect was further linked with the physical abilities of humans to withstand violence in accidents that occur in traffic. This notion was implemented with an approach that takes the physical abilities of a human to withstand crash impact, the ability of a vehicle to withstand an accident and the forgivingness of road infrastructure. By taking these known facts as a starting point to design the road infrastructure, cars and the speed limit system it is easier to control for fatalities, and also severe injuries which occur when road users are following the traffic rules. It will get more difficult to create the needed energy to severely harm road users who are in the speed limits of the system. The boundary rules for motorized traffic are presented in Box 2.



With these principles in mind the legislation was introduced in 1997. Since it requires time and money to introduce these principles there was no direct visibility of the measures which resulted in some critique. Until 2004 there was no decreasing in the number of fatalities (Rosencrantz et al., 2007). However as of 2018 the number has decreased with forty percent, and the number can be considered the lowest of any OECD country (Vägtrafikskador, 2018). The practical implementation and monitoring of Vision Zero uses management by objectives. This means that practical goals are set to reach zero fatalities. Moreover, Vision Zero was improved with new legislation in 2004 (Trafikutskottets betänkande 2004, 2007), these were made with the feedback that was gathered with yearly conferences on the topic.

This new legislation and feedback driven program consist currently of

fifteen road traffic safety indicators. These points are measured each year and are linked to a statistical model that calculates what the improvements should be for the measured factors in

**GNS Väg-** The Group for National Cooperation - Roads (GNS Väg) is an arena for the exchange of knowledge and coordination of activities within the area of road safety between important players with the aim of realizing Vision Zero.

**Management by Collective strategies-** A working method consisting of three basic components: objective facts, list of solutions and addressed actions. Many actors in society influence traffic safety, for example municipalities and the automotive industry. There is a requirement that these actors take increased responsibility to do what is possible to contribute towards increased safety on the roads.

**Nationell samling-** A national coalition from 2003 to 2006 over Road safety. Both industry representatives as NGO's to discuss about work and intend for Vision Zero on local and regional level. This has done in order to accelerate inclusion of actors and for the sharing of responsibility.

**Q3-** A forum for sustainable transport, in which members can exchange experience, share ideas and gain access to expert assistance.

**ISO 39001-** Concerns all organizations that want to improve road traffic safety. The purpose of the standard is that organizations should work more systematically with road safety, in order to save human life and reduce the human suffering because of road accidents. With an international standard, the preconditions are also established to ensure that the best available technology and practices attract greater distribution.

**Quality assurance of transportation-** a cooperation with actors that purchased and conducted transport where made.

Focus in the quality assurance was on five areas:

- Safe use of vehicles
- Safe vehicles
- Energy-efficient use of vehicles
- Energy-efficient vehicles
- Logistics and choice of traffic mode

**Swedish Traffic Accident Data Acquisition (STRADA)-** Traffic incident data from the police and medical services are collected. With the combination of these sources a proper understanding can be generated over traffic incident and their consequences can be provided.

*Box 3 Vision Zero ways of working*

order to reach the desired sub-goals (The Swedish Transport Administration, 2012). Items in this program are for example the amount of sober traffic, seatbelt usage and the amount of safe national roads. Each year is thus reflected upon those indicators to see where points of improvements lie and what the outcomes of taken measures are.

This is not the only way to monitor the proceedings of Vision Zero. Several ways of working with traffic safety have been introduced. These can be seen in box 3.

From the new approach Vision Zero has made, along with the new management style and knowledge sharing bodies, practical ways were established to get to zero. The operational strategy for Vision Zero has many unique features that are successful in bringing down the number of fatalities.

The first one relates to vehicle speed that is inherently safe to the system, as proposed with the new motorized speed limit system. This is often realized with the median barrier or the 2+1 road, this barrier is now a standard design on new roads where speeds are over 70km/h. The barrier is erected in the middle of a 2+1 road, meaning that it has two alternating lanes on one side and one on the other. This wired barrier prevents that a head-



*Figure 1 A 2+1 road in Sweden*

on collision can happen between two opposing drivers, which often have severe consequences because of the speeds that occur between road users and is deemed extremely effective, lowering up to 80% of fatalities on such roads (Johansson, 2009). Besides that, is the 2+1 solution is much safer than the roads that have no mid barrier, also cheaper than the four lane roads it replaces while maintaining almost the same traffic flow, which was clearly mentioned by interviewees B, D and N, a picture of a Swedish 2+1 road can be seen in figure 1.

Another practical outcome is the use of roundabouts. Roundabouts are usually not effective in lowering the amount of accidents, but ensure that when one occurs, the impact is much lower. Because of the lower speed these are ultimately responsible for the lowering of fatalities (Elvebakk & Steiro, 2009). Besides these measures, there is a focus on unprotected road users, they should receive increased protection with separate bike lanes for example. Another important practical measure is to improve vehicles to address unwanted driver behavior. In order to influence this behavior procurement for innovation is used, alongside an emphasizes of responsibility taking for road traffic.

One of those solutions is the alcolock, with this device the driver needs to be sober in order to start a vehicle. 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). Also, seatbelt reminders are used. When a driver does not wear his seatbelt, the car warns the driver that it is not engaged. Furthermore, takes the government a lead role in procuring cars in the way that they are equipped with the most recent safety features in order to get a faster and better market acceptance (M. Å. Belin et al., 2012).

Another unique example for Sweden is the use of the safety camera. This speed camera, by Sweden named 'the safety camera' are installed on roads which have a high record of injuries or fatalities but where it is not possible to take other measures such as the median barrier. Consequently, the cameras are always seen as an ultimate measure. The ticketing is done by the police who have a set amount of tickets yearly, this practically means that every camera is only operational for 10% as mentioned by interviewees E and F. To further aid in the effect of lowering the speed they are always multiple cameras on a road with a separation of 5 kilometer (Lindberg & Håkansson, 2017). Another specific item is that they always measure the speed of all passing traffic. Therefore, they are able to generate data on speeding and the effectiveness, despite that they have little operational ticketing time. All these measures show that the safety cameras are both very effective in lowering speeds on large stretch of roads, and that the public acceptance is very high (*ibid*).

At last the community of road users is stimulated to use the road system on a safer way. The evolution on the number of traffic fatalities in Sweden can be seen in figure 2.

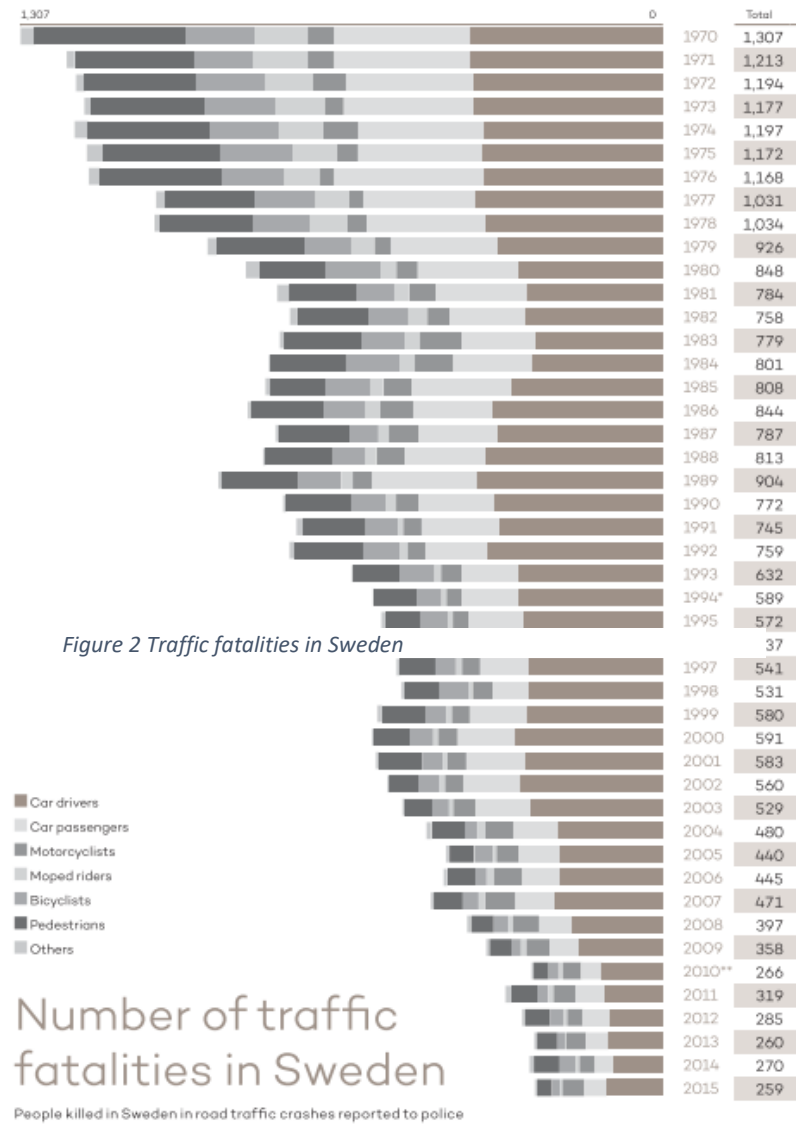


Figure 2 Traffic fatalities in Sweden (Lindberg & Håkansson, 2017)

## 5. Success factors of Vision Zero

One sub question of this report is what the success factors are in the Swedish Vision Zero policy. This question is important because by asking this question the reasons underlying the success of the policy in lowering the fatalities in the road traffic system can be uncovered. This success has also resulted in that other countries have copied the traffic safety policy as well as that it is transformed to other sectors outside traffic, possibly, as a way to operationalize Mission-oriented Innovation Policy.

To investigate factors that contributed to the success of Vision Zero, we follow two approaches. The first approach builds on the direct answers from interviewed people. During the interviews the question “Vision Zero is received as a successful policy, what are the main contributors for the success?” was asked. Direct from these answers the items were listed in a framework to see what the success factors are according to the interviewees. Since the interviews were semi-structured, this question has however not been asked to all people that were interviewed. In those four cases where the question was not addressed, the whole interview has been searched to items that the interviewees relate to the success of the policy.

The second approach builds on coding of interview data. A more detailed explanation of the coding process can be found in the chapter four. The list of attributes has subsequently been modelled into a simple theoretic framework for Vision Zero. For this section the factors that are related to the success factors are explained first and factors that are contribution to the context are explained afterwards. Together with the explanation of the attributes related to success and the model a broader context of the success factors can be provided.

Following the asked question “Vision Zero is received as a successful policy, what are the main contributors for the success?” interviewees could give a direct answer to what they thought are the most important contributors for the success. In the question is stated that the success should be about the policy of vision Zero and it was also emphasized in the beginning of the

interviews that uncovering the policy was the aim of the interviews and not the practical safety aspects. This is done because often success factors are only contributed to practical traffic safety measures as the 2+1 roads or roundabouts. But with this question the aim was to get deeper in the policy process and try to understand which underlying reasons are responsible for these practical outcomes. From the answers the interviewees provided an analysis was made which success factors they think are crucial for the success of the Vision Zero policy. The overview can be seen in table 3 underneath. Besides these factors direct quotes are provided to add more context to the success factors.

	Occupation	Trafikverket	Academic	Industry	Other government	Total	
	Number of people interviewed	6	2	3	3	14	
Success factors of VZ							Percentage
System perspective		4	2	3	2	11	78.57
Ethics		1	0	2	3	6	42.86
Best practice		2	1	1	2	6	42.86
Responsibility change		3	1	0	2	6	42.86
Broad cooperation		3	1	1	0	5	35.71
In dept studies		1	1	1	0	3	21.43
Ambition		1	1	0	1	3	21.43
Complete policy package		1	1	0	1	3	21.43
Education of VZ		2	0	0	0	2	14.29
Car industry		1	0	1	0	2	14.29
Public support		1	0	0	1	2	14.29
Management by objectives		1	0	0	0	1	7.14
Personal attributes		0	0	0	1	1	7.14
Procurement policy		0	0	0	1	1	7.14

Table 3 Success factors of Vision zero

Table 3 presents that the system perspective is regarded as the most crucial success feature of the policy, as eleven out of fourteen interviewees mention it, from all relevant actor groups. With the system perspective is meant that all factors that have impact on the traffic system should be harmonious in the way that everything should be designed on such a way that it is not possible, or very difficult to have fatal or severe accidents when users of the traffic system obey to the traffic rules. Therefore, a lot of improvements and measures can be allocated under this factor. So are not only infrastructural improvements part of this but also increased and new collaborations between organizations. Besides are increased learning processes and different

style of education people part of this as well. It comes down that the whole traffic safety system is approached more professional with measures and policies that are scientifically proven and thus to systematically approach safety that also deals with priorities.

Practically this means that the traffic system is designed in order to control that the energy levels in accidents cannot pass a certain threshold that is lethal for people. Examples for this are the 2+1 roads that are designed that vehicles traveling in opposing directions cannot collide with each other on roads where speeds are higher than 60 km/h, roundabouts that make sure that speeds are lower for crossing pedestrians or bicyclists. Another example is the speed limit system in Sweden. This new system is fully designed to consider the infrastructure of the roads, the safety level of vehicles and all other road users, such as bicyclists. Taking all these factors in consideration, the kinetic energy will ideally never be high enough to kill a road-user. This also manifests itself in the way that speed cameras are not placed at roads with a speed limit lower than 40 km/h, as the risk on those roads is not high enough for fatalities or severe injuries. Moreover, the systematic approach is also a way to increase cooperation and actor inclusion. By adapting all items in the road traffic system to each other, more cooperation and adaptation of each other's systems is needed. So can Trafikverket for example make enhancements on the infrastructure, but since vehicles also need to be thoroughly tested what the effect of these enhancements are, more cooperation is needed from private parties. Therefore, this approach has also increased information sharing between actors as automotive firms, Trafikverket and professional drivers.

A part of mayor interest is to see that this approach is not unique to Vision Zero as for example the Netherlands also utilizes a system perspective in the Safe system approach, what can be said is that both countries are equally good in bringing down the amount of traffic fatalities over the years. Therefore, the factor is of high importance but not unique to the Vision Zero policy considering traffic safety.

*"I forgot something, and it is the system perspective, because we work with humans, vehicles and infrastructure, but Vision Zero is about integrating this in a smart way. And you have the speed also that you have something you can adapt the system really, so this system perspective and you have system theories, system engineering and so on in this course and so. And that 1+1 becomes 3 and not 2 because if you do it smart you can understand the interactions between these different parts of the safe system, road safety system. It is much more effective." - Trafikverket employee*

*"If you are driving the right speed and sitting in a good car and using the seatbelt and still you are dead, why is that? Is that always the victim's fault? Or is it the engineer's fault? So that was a way of seeing the system in a different way." -Trafikverket employee*

*"I think when I have been studying how people talk about Vision Zero in other context and international organizations and NGO's and different experts working within this field they are really stressing the change from the behavioral approach to the systems approach." -Academic*

Also important are the next three factors which almost half of the interviewees answered to be important factors. These are the ethical approach, the change in the way of dealing with responsibility, and the usage of best practices.

The arguments for the ethical approach as a success factor are made because it is difficult to go against the aim for zero deaths. This item is historically seen very important with the acceptance of the policy. With the adaptation of Vision Zero, the ethical argument was one of the most important factors to accept and pass the new policy in society and in political spheres. As every person has a 'vision zero' for themselves, their family and friends it seems logical to impose this strategy on a national level. This subsequently results in a more ambitious policy where more attention is given to traffic safety and higher priority is given to measures to reach the goal. Another ethical example is the fact that it is by ethical standards very difficult to let the government provide a right number of fatalities in the traffic system. The ethical logic is that a set number of fatalities, which is often used in normal road traffic systems means that the government chooses that it is acceptable to 'kill' the set amount of people which is ethically impossible for a government that cares about its citizens according to the Vision Zero policy.



Furthermore, the ethical stance has provided Vision Zero with a lot of both national and international attention. The notion that the government of Sweden thinks it is the only right thing to have zero fatalities has created attention and therefore more pressure to work towards the goal and share information. So, ultimately it has not only legitimized the policy in the past when it needed to be accepted, but it created an ongoing pressure to be effective in lowering the number of fatalities.

*“It is very important because it says that safety is, when you would like to have mobility it should be safe, though it is a factor for the mobility, and if you say, you decide it is not okay to exchange some lives to exchange for more mobility as an idea.” Trafikverket employee*

*“I think the ethical part is the easiest part. I mean from a rhetorical point of view it is quite easy to track people in any ethical argument, I mean if I say that the only ethical right number in traffic deaths is zero, what do you say? There is very nasty follow up question, namely who? Should it be any of your family, that should be in that normal number of fatalities. So, I think the ethical part because it is very important and thus, we stress so much that only a limited part of outcomes of the vision because it is ethically so clear that you do not have the right to take anyone else’s life. That is why we don’t introduce a system that calculate with people being killed. So, I think the ethical and the logic in that is the easiest part and that has been the reason for the success.” -Trafikverket employee*

*“And that was picked up by the minister at the time and she was, that is an important element, she was a woman. And she very quickly said my vision for my family is zero, why should it not be zero for Sweden? So, it was fully logical that the sum of a lot of zero ideas should end up at zero as well.” -Other government employee*

The change in responsibility is mentioned because it has created a paradigm shift from the normal view about road traffic safety. This aspect has come from the statement that Vision Zero made, ‘what can be done?’ to the question ‘What must be done in order to create a safer road transport system?’. Since Vision Zero states that humans at all times will make mistakes, even considering high training levels and proper alertness of the driver, traffic accidents are bound to happen on the road traffic system. Therefore, the decision is made that people who are actively and professionally engaged in the creation and design of products and infrastructures, should put more efforts in making the items they produce are safe. This is

realized with an added responsibility for the system designers. Designers who are working with infrastructure and vehicles are encouraged to take more responsibility in their work and in the process of learning when accidents occur in the aspects where they are responsible for. This shift has enabled that safety has taken a higher place in the design process across the stakeholders that are involved in the road traffic system and the design thereof.

Although the concept of the system designer is practically not backed up with legislation as highlighted by Belin and Tillgren (2013) who consider this omission as an implementation failure, it is nonetheless mentioned as one of the most important success factors in the interviews. The authors argue that certain system designers who resisted Vision Zero principles such as road transport companies and municipalities could have been forced to follow these principles if the concept of the system designer would have been regulated. Despite that this has not happened, other policy tools as procurement for innovation and that Trafikverket uses the concept of system designer in their work has already brought such important changes that nevertheless half of the interviews mention it.

*“Well we talked about the responsibilities. Not relaxing responsibilities on anyone but adding responsibilities.” -Employed at a governmental organization*

*“And call is us now in relation with the working unit for the government and so on. We as government and state authority and providers of transport services and cars and what it might be. That are ultimately designed how many people are at risk. Because we can apply very good solutions, or we can apply very bad solutions. If you know that with a roundabout the risk for a fatality for a car occupant is only 5 to 10% compared to a signalized intersection, then you can't blame people out there really.” – Employed at a governmental organization*

*“There was the interesting discussion about a week ago or so where the managing director of Transport Styrelsen was talking about a lot of the heavy traffic and it sounded like he was putting a lot of the blame on that kind of business really the transport business, not only the international but also the Swedish transport companies as well and I think, I think he was no supposed to be that kind of pointing the finger you are the ones the blame with the heavy traffic and crush all the other vehicles on the road it was more of creating a debate on responsibility and this kind of shared responsibility that there is.”*

Best practices are often mentioned because it relates to the practical measures taken in the process of minimizing the amount of traffic fatalities. It is often mentioned together with the underlying logic that all measures should be based upon scientific principles. This adoption of this logic stems from the medical origins of the principles that Vision Zero is based upon. This means that only practices and methods with a scientific background are accepted. It should however not be only seen as treating patients when they are ill but also to prevent them from getting ill, what is even more applicable for road traffic. Along the whole accident chain, from the moment increased risk arises being part of traffic to a post-crash situation, the best practices must be taken to minimize the risk of fatalities.

An example for increased risk is the driver alertness system in vehicles that warns the driver when they deviate from normal driving behavior, to vehicles that automatically call emergency services when a severe crash has occurred in post-crash situations. Looking at the infrastructure, practical outcomes of these are the implementation of the 2+1 roads, roundabouts, but also constant improvements of these measures as for example the unique safety camera system that is already at its third revision in terms of technical specifications and ways to use it. Furthermore, is there not only a focus on practical aspects, but also on the policy behind Vision Zero and the way of working. These aspects are also revised with new practices as the vision was relaunched in 2004 and 2016. Both these revisions were aimed to make sure best practices of working are realized to come to practical results.

*“There has always been in medicine and so on, but they have set up better and more rigorous ways of dealing with new knowledge, that is called the code of practice. For example, now we know that malaria should be treated this way and not like in the past. This happens quite quickly because a doctor doesn’t want to be seen as unprofessional or old-fashioned sticking to old ways. You have to be at, almost of the top. But we are not there in our environment yet. That is more is more of a problem, and I have no other solution that the world should exchange more.”*  
– Employed at other government organization.

*“You can get really puzzled with people. For example, the US or china and then you look at their massive investments in doing construction and see them build the same stupid intersections that they used to do, signalized high speed intersections. And you wonder why on earth do they do this? It doesn’t cost them more to build a safe intersection, it has not a lower capacity. A*

*roundabout normally even has a little higher capacity. If you look at all the traffic flows. And it is so much better and people like them so much better, and still you build the old ones. And then on earth why is someone acting in a nonlogical way.” Employed at other government organization*

Another success factor is broad cooperation mentioned in five interviewees. This factor mainly relates to cooperation with NGOs and industry. Through intensive cooperation a wide range of stakeholders is activated to work with the Vision Zero policy. This is often set up in a reciprocal way of working together to ensure that both parties have equal gains from the cooperation, while keeping the Vision Zero principles in mind. Example of these collaborations can be found with the automotive industry where Trafikverket and the industry share knowledge and information about the development of infrastructure and about fatalities, so are they able to take these changes in mind for the developments of new vehicles and new infrastructures. Another successful cooperation is the story of the speed camera system in Sweden. An external consultant was hired to mediate between the private companies and Trafikverket. This was done to ensure that the right knowledge of project management was present, a capacity that Trafikverket lacked. Moreover, time was taken to develop and test the system to make it mechanically proven. Furthermore, cooperation was sought with the police as they are the organization that tickets speed offenders.

Besides these examples platforms were established. SAFER in Gothenburg is an example of an innovative platform where work is performed on Vision Zero and road traffic issues whereby the government funds half of the costs. Also, an important collaborative platform is the GNS Väg which stands for The Group for National Cooperation – Roads. This group forms an arena that holds six meetings per year for dealing with current traffic issues on the road traffic system. The actors in the platform are for example automotive firms, the police, ministries, municipalities and regions. More of these newly established platforms can be seen in chapter four in box 3.

*“I think that was also an important success factor, that we started to work together with other stakeholders, or actors or whatever you want to call them, and it was not just the question*

*between the government and the individual road user. We started to include other actors or stakeholders in the work. Like road haulers, taxis, busses and so on, and I think that was and because they in 2007 or 2008 or something like that we worked with, we worked out the target for 2020, we did it together with different stakeholders that was the first time really.” -Employee at Trafikverket*

*“But Trafikverket they also felt that they needed to be part of something. And there is a lot of cooperation like the STRADA is one that. It is another example of cooperation you can have between governments and industry,” -Industry*

*“They have set up center in Gothenburg, called SAFER. So that is more like a test form for different researchers and different companies. That are working with the Vision Zero, so it should be like a platform where you could connect to, some projects and this is everyone that is connected to it is paying a part of the fee.” -Industry*

Other success that were mentioned multiple times are in-depth studies, ambition and the role of the car industry.

In-depth studies are the studies that are made when a fatal accident occurs. This method of incident investigation was started back in 1997. In-depth studies offer insight into the causes of traffic fatalities. An important starting point for the in-depth studies is to analyze the chain of events that resulted in the fatal injury. The goal of the in-depth studies is to obtain the best impression as possible of what happened before, during and after the accident occurred. All the gathered information is compiled and analyzed at Trafikverket where people skilled in vehicle mechanics, road design, traffic engineering and behavioral science investigate the data. Investigators can also call on experts from the health services, police, emergency services and local authorities to further complete the causes of the accident.

The data is subsequently used to address dangerous roads or areas and to take measures. These have proven valuable to discover new patterns and monitor patterns in road traffic fatalities. Furthermore, can by using this system the areas with the highest priority be dealt with first, thus always getting the best results on improving the road traffic system

*“It is well the key part of the systematic approach to all the accidents not only identify the actual crash itself, but what is the situation do we have more similar situations and mapping that across the country, time consuming but efficient in that way that you can look at similar situations, similar infrastructural situations such as how do you build a bridge over a highway.” - Academic*

*“And one activity that we as the Swedish transport administration that we carry now based on it is these in-depth studies of fatal crashes. Because that is one way for use to take responsibility and to see what we can do to prevent these fatal crashes to occur in the future and so on.” - Employee at Trafikverket*

Ambition is named as a success factor because of the target of zero deaths and injuries has created. Multiple times it is mentioned that setting such an ambitious target has helped in achieving goals and going beyond work that would normally be done with less ambitious aspects. Further it is mentioned that the ambition keeps people working with the policy sharp and focused to reach their goals. This not only means that individual people are more motivated to work on their targets, but it also created pressure from outside as politicians expect improved results year after year. Besides that, the goals of zero thus establishes this ambition, also interim goals, ensure ambition to work. These interim goals are partly decided upon with political involvement and they always make the goal ambitious, as goals that can be met easily are not worth putting out and give wrong signals from the government.

*“So, targets are tricky things and setting targets you know you can achieve is from my perspective not very meaningful. It is better to be a bit inspirational in your target setting and not getting there. And the alternative is to be very careful and not really daring in setting your targets and they you are never sharpening your tools so much, it will be business as usual and hopefully you can get there but aspirations are not really high.” -Other government*

*“So, it is political signal to half the 50% in ten years, even if the road administration did not know exactly how, to reach that goal. So, it is a political goal, but it is, so that made a challenge. The goal, the level was reached two years later in 2009. I am not sure, the figures I don't remember, you have to check it. But two years later you reached the goal, we are almost in the same position now, I suppose we won't reach the target for 2020 but maybe two years later or something like that. So and then we always can say, you did not reach the political target but the target has had its effect it is gives strength to the road safety work it gave focus for the road*

*safety work it is something to get together with other stakeholders this is the target how to reach it. So, I am not that disappointed that we did not reach it. And many say that if we don't reach that short time, or mid time target with many, sometimes they say, we don't reach the Vision zero, okay, but we are on our way.”- Employee at Trafikverket*

Finally, the automotive sector was mentioned multiple times as a success factor. This has primarily to do with the fact that there is a unique relation in Sweden with the automotive industry, Trafikverket and other governmental bodies. Historically, the automotive sector with companies as Volvo and the now defunct Saab always prioritized safety in their product development. Following Vision Zero, Volvo has even developed a vision zero for their own cars. This policy contains a vision that no person should be killed in a new Volvo in Sweden in 2020. This has further strengthened the case for Vision Zero by creating more legitimacy for the policy from the industry. Furthermore, it required more intensive relations with Trafikverket. This is needed to both align the vehicles and the infrastructure in order to make sure the target will be met.

Besides these special relations and the willingness of the industry to pick up the Vision Zero principles also other developments are interesting. So is it mentioned multiple times that just the technological improvements of the vehicles looking at crash safety, but also active measures such as electric stability control and seat belt reminders have helped greatly in reducing the amount of traffic fatalities. These developments are only partly influenced by Vision Zero but nevertheless have helped a great deal in improving the traffic safety. It is also notable that Volvo has a large market share with around 20% of the market and thus the vehicle fleet could be addressed as one of the safest in Europe.

*“And I would say that is difficult, but in the same time if you look into Volvo now for example some of the things that the car industry is doing now, they are doing it from kind of voluntary perspective you know and now they even discuss to setting speed limit.” -Employee at Trafikverket*

*“Well I think that one of things I think about is about Volvo, the car industry has used Vision Zero as part of their own safety campaigns and making them these, the products that they are making it plays with them, not against them, and for some other car manufacturers safety has not been that it has not been that important as it has been to Volvo, they have made the choice to market the cars safety as an aspects, other haven’t. And so, I think a lot of the safety innovations are coming from the car industry has been crucial to underpin Vision Zero.” -Scholar*

Other success factors are only mentioned once or twice or less and are therefore not further discussed. Explanations of factors such as personal attributes and management by objectives will be discussed more extensively in the next chapter or appendix that explains the outcomes of the coding process.

As an additional analysis, we look at what groups of interviewed people have mentioned regarding success factors. Here, we distinguish between four groups of people. Employees at Trafikverket, two scholars that are academically engaged with Vision Zero, three industry interviewees, and three government officials dealing with the Vision Zero policy, but not working at Trafikverket.

What can be observed looking at these groups and what they list as success factors for Vision Zero is that there are no large differences. All the groups of interviewees list mostly the same factors for the success. The only small differences that can be seen is in ethics, as it is always mentioned by other government people, and almost always by the industry. Trafikverket employees and academics however mention such factors less. This is however the only factor where something mentionable can be observed. This means for the Vision Zero that a shared vision is present among different actors working with the policy, suggesting the vision sharing of the policy has succeeded in its goal to create a paradigm shift among stake holders in that they share a common understanding of Vision Zero and what drove its success.



## 5.1 Attributes from the coding framework

In this section factors from the coding are presented. As describe in the methods chapter these factors have been created during the coding process of the interview data. In this section the attributes that are contributors to the success of the policy and factors that bring context to the policy are discussed. Likewise described in the methodology chapter the process of coding was performed using open, axial and selective coding to produce a list of attributes. Following these attributes of success and context.

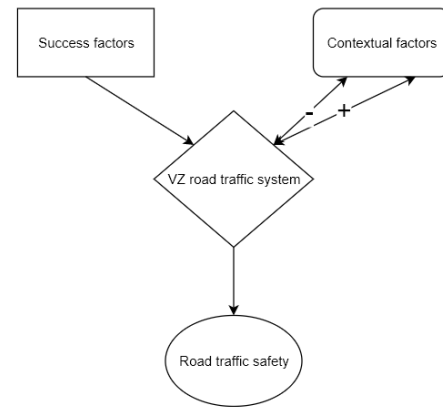


Figure 3 Framework of Vision Zero

As can be seen in figure 3 the main model of the coding has led to two main areas of attributes. The ones that are directly contributing towards the success of the policy and the ones that provide context for the policy. The contextual factors can be both have positive and negative influence over the policy. moreover, are some interactive, to a certain extent influenceable by the policy while others are not. In the end this results in a road traffic safety.

### 5.1.1 Success factors from the coding framework

For all the attributes that are related to success, the coding overview is provided. First, a reference is given that relates to the codes that can be found in the attribute. Second, an interpretation of the attribute will be explained in the context of the Vision Zero policy. When an attribute contains not many codes and if they are not often mentioned this has been merged into one section. Alongside the description of the attribute a figure is provided with the codes that are grouped under the attribute. In the figure the first number is how many times it is referenced in an interview, the second number how many times in total it is referenced in all the interviews. The higher these numbers are, the more there is talked about a particular

subject. Sometimes have less important codes been reduced to sub-codes, which are presented as a lower rank than the codes.

### Properties continuous improvement (Success factor)

Looking at the codes of continuous improvement the **learning attitude** is mentioned twenty-two times out of nine interviewees. This code considers the policy wide stance to always learn and be up to date in scientific developments that can contribute to a safer traffic system. Further it also means that the people engaged with the traffic sector always need and want to learn what is going on in the traffic sector and what the development are in the fatalities and severe injuries. In this way new types of causes or patterns can be uncovered, doing so means that the newest policies and measures can be taken upon new developments.

4.Continuous improvement	0	0
best practices	8	12
continious improvement	7	12
Learning attitude	9	22
Measurable to control	5	6
quality systems	2	2
refelction upon results	1	2
renewed commitment	4	4
Seeking for attention	1	1
safety in other sectors	4	4
Workplace safety	2	2

**Best practices** and **continuous improvement** are both named twelve times and are closely related to the learning attitude but are more practical outcomes of the attitude that the policy has created. Besides are they named by almost the same number of interviewees.

**Measure to control** is named five times as it is related to the quality systems Vision Zero is loosely based upon. Therefore, aspects affecting traffic safety first should be mapped and measured in order to improve it and monitor the effect of policies and taken measures.

The Vision Zero approach is tightly linked to quality systems and continuous improvements that were developed in the 1980s in the industry. This manifests itself in the way that things that need improvement should be measured first in order to measure progress and effectivity of measures. Moreover, this reflects that always best practices should be applied in order to guarantee the best safety practices. This is also demonstrated with two relaunches of Vision

Zero in 2004 and 2016. While there are multiple reasons for these relaunches, such as reorganizations and less political support, the goal is to formulate the best policy to the most contemporary goals.

**Properties Demand articulation (Success factor)**

Both the Industry, mainly the Swedish car industry and the government with the parliament and Trafikverket have found out during the implementation of Vision Zero that

5. Demand articulation	0	0
Market for safety	8	13
Market push	1	2
What is the demand	6	11

a **market for road traffic safety** exists. Moreover, is the installation of the Vision Zero policy also a demand articulation as the parliament is directly chosen by people in society. Before the policy implementation it was thought that a market for traffic safety was nonexistent. With this notion in mind both Volvo cars and Trafikverket actively further developed the market for safety and to research **what the demand** actually is around traffic safety. with procurement tools and creating awareness for safety. By doing this, innovations could be better placed in the market to increase the adaption rate and proper usage of the safety items.

**Properties information sharing (Success factor)**

Looking at the codes in the attribute of information sharing, it is observed that **collaboration** is most widely mentioned with twenty-seven times out of eleven interviewees. This code refers to the many collaborations Trafikverket has established under the Vision Zero policy. These collaborations have many forms such as pure industry collaborations with Volvo cars for example to perform joint work on vehicle infrastructure aspects. But also, intra-governmental collaborations with the police and hospitals to retrieve injury data and at

8. Information Sharing	0	0
campaigns	1	1
information flows	1	1
sharing platform	1	1
differences in size	1	1
innovation platform	2	2
mutual benefits	5	5
inclusivity	4	6
collaboration	11	27

last very broad collaborations that are taken up in yearly follow ups that included many actors that are engaged in traffic safety. Besides these widespread collaborations that are established under the Vision Zero policy they have also proven to be successful as these parties want to engage in them and Trafikverket thus is able to better articulate their vision and goals in traffic safety. This also brings forth the codes of **inclusivity** and **mutual benefits** as the whole spectrum of interviewees mentions that everyone that engaged in these cooperation's have benefits that fall under the Vision Zero spectrum.

The sharing of information and collaborating on traffic safety measures is a thing that is highly addressed in Vision Zero. So are there several industry-government collaboration platforms in order to gain mutual benefits from each other while increasing the traffic safety. Also are innovation platform established to share knowledge and bring parties together to work on issues regarding traffic safety.

### Properties taking responsibility (Success factors)

**Responsibility** is one of the main aspects of the Vision Zero theory. The code responsibility is most named out of all codes with thirty-six times

9. Taking responsibility	0	0
centralized body	1	1
responsibility	12	36
Social Corporate Responsibility	3	4

form twelve interviewees. The change in responsibility concerns foremost the introduction of the system designer concept. This concept means that responsibility has been added to the designers of the road traffic system. This includes both governmental organizations responsible for developing the infrastructure and private companies. This concept has taken of as a social norm and can be seen in many items in the traffic infrastructure. One mayor drawback is that this shift in responsibility has not come with legislation and therefore it is more of a paradigm shift than a change made with hard measures. Consequently, resisting private parties are not forced to take more responsibility, it is thought that with **social corporate responsibility** this can be achieved in lagging parties such as transporting companies.

**Properties Key Success factors. (Success factors)**

In the Key success attribute many factors that are mentioned multiple times have been gathered, the most often mentioned factor is **systems thinking** with twenty-three times. This code reflects the systems thinking that is one of the most important factors in the policy. With the installation of a systematic approach towards traffic safety many lives have been saved. By designing all the parts of the traffic system, like the infrastructure, vehicles and the way they should be used in a harmonious way the system can be improved for safety. This has practically examples for example that the speed limits are totally changed to create a better understanding with vehicles and their surroundings to minimize the amount of kinetic energy.

The **publicity** code which is named twenty-one times reflects the positive publicity Vision Zero has received and also what it actively has created. Moreover, this is applicable to both national and international countries. These efforts have thus led that the policy could be properly articulated to society and has created momentum to perform the transition to the new policy. Further is political support deemed a factor that contributes to the success of the policy. Because it got a full political approval of the Swedish parliament, every political party in the Swedish parliament voted in favor off the policy. The **political support** has since the approval more than twenty years ago not been abandoned and still is present. Besides a long-term commitment from the political standpoint, this also meant that legitimacy was created for the policy in order to transform the traffic safety system.

11. Key succes factors	0	0
ambition	9	14
ethics	10	17
External shock	2	2
Goal oriented	3	5
political support	9	20
progress	5	12
Publicity	9	21
safety culture	10	13
Scientific background	9	16
research institute	1	1
Smart spending	9	16
Costs of saving lives	1	1
Systems thinking	10	23
Traffic as a relatable topic	3	3
Vision Creation	5	7
zero fatalities	5	12
quantified target	1	1

**Ethics** is also a prevalent code, as it is mentioned by ten people. The ethic approach of the policy is one of the most unique features the Vision has. Aiming for both **zero fatalities** and severe injuries it is articulated that the Swedish government states that it is not ethical possible to determine a right amount of people that die on the road traffic system. This argument is also used to deal with opponents, because everyone has a Vision Zero for themselves, thus it should only be the right way as the government also uses this mission. **Scientific principles** are mentioned sixteen times and contain the information that all measures that are taking in the Vision Zero program should be proven to work and be based upon scientific work. This ensures that the environment is kept professional and externalities are minimized. **Smart spending** is also mentioned sixteen times, this code contains mainly the practical items that since the introduction of Vision zero have been installed in the infrastructure. So is a roundabout for example a bit more expensive than a signalized intersection, but multiple times safer. This also holds for the 2+1 roads, which are 85 percent safer than the double lane highways they replace while being cheaper and only have a slightly lower flow of traffic. **Ambition** is also frequently coded as they state that the goal of zero creates ambition to solve problems and keep everyone engaged with the policy active and trying to overachieve in their work. **Safety culture** has been coded fourteen times and can be explained twofold. Firstly, it relates to the culture that is present in Sweden before Vision Zero was started and still is today. This provided an environment where the program could be developed and approved. Further it relates to the culture that Vision Zero has established. With the aim for the double zero and ethical stance a stronger safety culture has been established in traffic sector, ensuring that a global drive for safety is made.

Vision Zero has brought many items that make this policy a success and are captured in this attribute. So is the ambition of the quantified target to get to zero fatalities importance and keeps everyone sharp to do their best. Moreover, is the fact that it is based upon scientific principles a key in saving the lives of people, knowing what kind of violence they can withstand in a crash. Also, the ethical part stating that nobody should be killed in a traffic accident when they are following the rules makes a very strong part for the success.

## Properties VZ ways of working & getting things done (Success factor)

The **policy package** and **implementation** were factors that were both mentioned fourteen times. Implementation is covering the basic aspects of getting the policy to work and get practical measures out. The policy package contains the wide range of policy tools that are used for Vision Zero. So, it the articulation of a mission one of these, but so are procurement, standard setting and intensive cooperation included to give some examples. This makes sure that a wide spectrum of measures is taken to really increase the safety in road traffic and involve as many actors as possible. It is also mentioned that this package of policies makes it able to successful transform the policy to other countries that want to cope the approach in traffic safety.

**Long-term commitment** is especially mentioned as a successful way to work with Vision Zero. All the actions that are taken for Vision Zero are developed for long time frames, and don't favor short term results. This resulted also that in the first five years of the policy no real increases in safety could be seen, while after this period a steady declined can be observed. **Priority setting** is also listed as a factor contributing to the success. Problems with the most priority, meaning that roads with a high

14. VZ ways of working & getting things done	0	0
Getting things done	0	0
increased attention	1	1
Methods for change	1	1
legitimacy	2	2
Private initiatives	3	3
grassroots movements	3	4
local initiatives	2	3
Industry support	4	4
Insurance companies	1	1
Severity	4	9
implementation	8	14
policy package	8	14
VZ ways of working	0	0
Upscale for effects	1	1
bottom up perspective	1	1
diverse solutions	1	1
Speed limits	1	1
Educate politicians	1	1
maintennance	2	2
safety research	3	4
performance indicators	3	4
managment by objectives	3	5
Traffic system	3	5
Accident prevention	4	5
Human weaknesses	4	10
Human Factors	1	1
Vision sharing	4	9
Difference of intepretation	1	1
Top down perspective	5	7
Eductation	5	10
Priority setting	5	11
safety mindset	6	8
procurement	6	9
Long-term commitment	8	13

fatality rate are being addressed first. By doing this the largest problems are dealt with first and thereby significant gains on improving traffic safety can be made. Also, **Education** is an important code. The codes stress the importance and made efforts to educate people over Vision Zero. This relates to both politicians who come into power for traffic related functions to children in lower school. This indicates that by investing in the education of people who play an important part of the traffic system, large gains can be made to ensure the vision sharing and is therefore listed as a successful factor. **Human weaknesses** are mentioned because this plays a large role in practically improving the traffic system. The systems approach is fully centered around the amount of violence a human body can endure. By doing this the whole system can be designed on ways to minimize these forces. Further things like seatbelt reminders are also an example of human weaknesses, as most people that don't wear seatbelts don't do it because they do not want it, but because they have forgotten to put them on. But besides these examples of the ability of a human to cope with violence it is also taken in mind that how alert and educated a person is, mistakes will always be made in traffic and therefore the system has to be designed that these failures will happen despite efforts to prevent them.

The ways of working & getting things done are both considered practical process aspects of the policy and therefore they are combined with each other. Considering the ways of working mainly the practical things in the road traffic system are attributed. So is in Sweden the policy developed from a top down perspective and is made sure that the vision is shared across all relevant stakeholders. Also are procurement tools a way that is often used by the Vision Zero policy to reach goals towards traffic safety. Another important aspect is the priority setting, meaning that the most dangerous roads, or aspects that cause the most severe and lethal accidents are addressed first, and not where the most accidents happen.

Reflecting to the part of getting things done mainly aspects are about creating legitimacy for doing for the Vision Zero aspects. So can Vision Zero be seen as a complete policy package that deals with multiple aspects in order to get to results. This includes getting the support from the industry as well as citizens.



## Properties Innovations (Success factor)

**Innovations** play a significant role in the Vision Zero policy and is therefore often coded. Both **Service innovations, Policy innovations** and product innovations have their place in Vision Zero. So is Vision Zero often mentioned as a policy innovation along with other innovative policies such as procurement for innovation. Practical innovations that are part of Vision Zero are the 2+1 roads, the alcolock and the safety camera system that have been taken up in the infrastructure. The end goal of these innovations is to **influence the behavior** of people in the traffic system to create a more safety and awareness. This is not only in influencing while driving but also in preventing certain actions such as the alcolock does, where it is not possible to engage in undesirable behavior.

19. Innovations	0	0
Innovations	12	31
Behavior influencing	7	9
Innovation driven from ou	1	1
policy innovation	5	9
service innovation	2	2
value of innovations	1	1

## Properties Increase in fatalities. (Outcome)

Finally, it is important to reflect on a common remark by interviews that the success of Vision Zero in very recent times is somewhat questions. Looking at the codes in the fatality rate of the traffic system there has been an increase that has occurred last year in 2018. The argument is often made that an increased economic growth has a high correlation with the amount of traffic fatalities, as history has shown this multiple times. With **high economic impact** the traffic fatalities rose, and with downturn in the years afterwards they declined in a faster pace than they increased. The curious part in the recent years is however that the economy has been increasing for several years in Sweden while only in 2018 the fatalities increased, with a rather large amount. Moreover, are **risk groups** named several

2. Increase in fatalities	0	0
Cycling problems	1	1
Economic impact on traffic	5	6
Increased bike safety	1	1
Risk groups	2	3
risk groups	1	1
Weather impact on safety	1	1

times as a high priority target in increasing safety, considering the increasing amounts of **cyclists**, but also new developments of risk groups such as e-bikes and e-scooters fall under this category. Further it is interesting to note that harsher **climates** in the winter in Sweden, meaning more snowfall and colder temperature have a positive effect on traffic safety as people are generally driving slower and thus lowering the chance of fatal accidents.

In the last five years, the decline in traffic fatalities has not been as strong as before, and in the last year the figures even went up, what is almost a European wide occurrence. To combat this undesirable trend the reasons have first to be established. Since so far it is only one year of excessive change and it also is very recent, not all data is gathered, or attributes researched, even if stakeholders seem to agree that heavy traffic and cyclists underlie the increase. Moreover, is an increase in economic activities highly listed as one of the contributors for the increase, as a higher economic state relates to increased traffic and more heavy trucks on the roads. For this attribute only mostly external sources of the problem are mentioned as others that are more important are grouped under a more relevant attribute that are parts of processes.

## 5.2 Contextual factors of Vision Zero

In this section the contextual factors that have been developed during the coding process of the interviews are elaborated. The name of contextual factors has been chosen because these factors do not contribute directly to the success of the Vision Zero policy but provide more explanation of the policy and which factors have impact upon the working of it. The contextual factors can both have positive and negative influence on the policy. Another feature that the factors can be classified into is the interactivity of them. Some factors are pure contextual and are seen as purely autonomous, such as country specific factors, while others are interactive and can be influenced to a certain extent, such as the automotive industry.

First the positive factors will be explained in this section, followed by the negative factors. Likewise, with the previous section a figure will be provided to show which codes fall under the attribute.

### 5.2.1 Positive contextual factors

#### Properties Vehicle industry (Positive context)

The codes in the attribute of vehicle industry are mainly about the developments that have been made in vehicles safety. More than half of the interviewees mentioned that the **increased safety of vehicles** has had a large share in the improvement in traffic safety.

1. Vehicle industry	0	0
Autonomous vehicles	7	9
improved cars	8	15
Technology cycle	1	1
branding strategy	1	1
vehicle industry	4	4
Safety feature	1	1

This can be partly contributed to Vision Zero. As the Swedish automotive industry has cooperated with Trafikverket on safety matters and have even developed a Vision Zero themselves. Other automotive firms outside Sweden have less connection with the policy and have also developed safer vehicles. This gives this factor a bit of interaction as Trafikverket can leverage influence over certain parts of the industry, but largely they will make their own decisions.

**Autonomous vehicles** are a high potential in saving lives in the future. This code is often mentioned because this was an optional question when there was enough of time during the interview. While the developments are a positive thing considering traffic safety all interviewees are unanimously that is much further away from full implementation as the **industry** is promoting. Further contains this code also multiple factors over externalities as autonomous cars in the current stage still is a technology that is mainly engaged with industry and thus has a narrow social inclusion.

Over the last decades the vehicle industry has made great improvements in traffic safety, both for vehicle occupants and other users of the traffic system when it comes to injury protection in both active and passive ways. The industry mainly works with technology cycles and thus this should manifest in early adoption of a novel technology and a following saturation afterwards. Interviewees state that this cycle can be observed in the rate of traffic fatalities. They further mention that currently the cycle is at an end of saturation and therefore they list this as one of the reasons why traffic fatalities are not steadily decreasing. Moreover, they state that the next and probably ultimate cycle will be autonomous cars. This development is however critically asserted as the automotive sector pushes this on the market to solve all kind of problems, while simultaneously creating many externalities. A uniform conclusion is however that all the developments for autonomous driving are for the benefit of traffic safety.

### Properties Transformation to VZ (Positive context)

Looking at the codes in Transformation to Vision Zero, **transformation** is often mentioned, counting twenty-seven times from ten respondents. The code contains the

6. Transformation to VZ	0	0
Divert from the old policy	10	17
transferability	1	1
transformation	10	27
transormability	1	1

transformation from the old traffic safety system to the new policy package of Vision Zero such as the system perspective and the ethical stance. **Diverting from the old policy** is somewhat less often mentioned in the interviews, but by the same amount of people. This code mainly concerns what was working well in the old traffic safety system. Thereby it underlines the reasons which reasons contributed towards the transformation of the policy. Furthermore, is two times mentioned how other aspects in society can transform to a vision Zero type policy.

There is much discussion about how aspects regarding traffic infrastructure and legislation should be transformed to facilitate VZ. Additionally, is discussed how it could be transferred to other sectors and what aspects of the policy could be useful or are necessary in order to reach results.

### Properties Financial attributes (positive context)

Considering the financial aspects around the Vision Zero policy it can be stated that no great structural **budget increase** has been made. Besides that extra funds were invested in the beginning of the policy, **spending** of the available funds for traffic safety are been spend smarter and more effective. However, several financial and economic measures have been made to make sure that **economic incentives** are created to lure companies in the Vision Zero way of working. Moreover, has money been spend on smarter ways in order to save lives than before and has money been allocated for innovations.

13. Financial attributes	0	0
spending	7	12
Increased spending	1	1
Budget	1	1
cost benefit	3	4
costs of innovations	1	3
Economic incentives	1	2
Investments in new technolo	1	1

### Properties Country specific factors.

Concepts that are unique to Sweden are captured under this attribute. These give more context why certain **country specific** aspects happen and why policies came to be. So is for example the fact that Sweden is geographically a large country with a low population density an important factor in traffic safety. Furthermore are codes containing a governance structure that is open and unformal mentioned.

16. Country specific factors	0	0
Country specifics	4	6
Regional problems	1	1
unfair competition	1	1

## Properties Side goals and future goals (context)

This attribute is mainly loaded with challenges that are important in the future. So are **future challenges** mentioned because of problems that are or can emerge in the future. So is one of the future challenges to see how everyone should deal with a more diverse traffic mix. With the emergence of more diverse bicycles such as e-bikes, cargo bikes and e-scooters the complexity of how to deal with each other increases.

18. Side goals and Future goals	0	0
Comfortable life	1	1
Future challenge	8	17
Future goals	8	18
improve transport sector	2	2
integration of problems	4	4
Liveable cities	2	3
Succes from VZ	1	1
sustainability	4	9
Vision zero 2.0	1	1

**Future goals** are mostly mentioned in the trend of the ongoing efforts to reduce the amount of traffic fatalities and are therefore more in the traditional sense of traffic safety compared to future challenges. **Sustainability** is coded because in the future sustainability should be better integrated in the policy. this means that not only cleaner vehicles regarding emissions, but also the sustainability in general such as active mobility, livable cities.

### 5.2.2 Negative contextual factors

## Properties Disadvantageous factors

The attribute of disadvantageous factors consists out of many codes, but several are only mentioned once. **Weakened drive** is mentioned the most often. This code contains both the drive from a political standpoint and inside Trafikverket. They both suffer from same underlying reason, with steadily lowering the amount of fatalities in the traffic system the drive became

weaker to start new measures and do more for safety as the results were in order. Last year the fatalities however went up and several codes indicate that a weakened drive of the people engaged with traffic safety work have less drive than it should be. Further is **enforcement** coded as a having a negative impact on traffic safety. With reorganizations in the police force enforcements went down. It is often mentioned that the enforcements should be increased rigorously in order to achieve better compliance with traffic rules as speeding and drunk driving. **Societal problems** are causing problems, these include truck drivers from eastern Europe that are notorious for drunk driving, people not complying with speed limits and children that are not educated good enough to manage themselves in traffic.

12. Disadvantageous	0	0
wrong solutions	1	1
bureaucracy	1	1
Lack of high s	1	1
Ease of reachi	1	1
car age	1	1
deregulation	1	1
Lack of ambition	1	1
Victim of succes	1	1
shortsightedness	1	1
Latent measures	1	1
low political urge	1	1
Freedom of mobil	1	1
externalities	1	1
reorganization	2	2
Heavy traffic	2	3
industry readiness	4	4
Lack of VZ princip	4	4
Market limitations	2	4
Resistance toward	3	4
Societal problems	6	10
Enforcement	6	13
Weakened drive	6	16

For the implementation of Vision Zero, and getting all stakeholders on board, there were a number of factors that had to be dealt with. So are some industries not dealing with traffic safety or taking responsibility in the traffic system, which could prevent numerous traffic fatalities, according to Trafikverket. Besides these items there are concepts highlighting lack of ambition towards certain bodies, that no, or wrong measures are taken regarding traffic safety and that political urgency is not always on point.

### Properties Societal developments (context negative)

The codes of the attribute societal developments are mainly negatively loaded, besides are the codes often only mentioned one time. The code that is six times mentioned is **social norms**. It is stated that social norms gradually develop in a negative way looking at past developments. So are generally aspects that measure safe driving such as speeding not declining in general, despite that measures such as lower speed limits and automatic speed control have been installed.

10. Societal developm	0	0
zero tolerance	1	1
Cultural difference	1	1
Driver distraction	1	1
individualism	1	1
social norms	5	6

The attribute of societal development consists mostly of aspects that are changing in society and often have a negative influence on traffic safety. So is the is thought that the large influx of immigrants for example could form a problem in traffic safety as they don't have the same safety mindset as the Swedish people. Further is distraction on the road a large problem with smartphones.

### Properties Regulations and Legislations (Context negative)

The most often mentioned code in the attribute of regulations and legislation is **jurisdictional clashes**. This code only contains negative loaded codes because with the transformation to Vision Zero principles legislation and regulation have not been adjusted to suit the new principles of the policy. Therefore, parties that are not willing to adapt to these principles cannot be forced by law in order to comply. This has led to conflicts with Trafikverket and rural municipalities for example. To

15. Regulations and legislation	0	0
regulations	3	5
Juristition clashes	8	11
Conflicting parties	3	4
Lack of power	1	1
Problem in traffic safety	1	1
politics	1	2
Political pressure	3	3
Political goals	2	3



solve this problem, **regulations** should be changed according to Trafikverket. However, **politics** and the **goals** they have are not urgent enough to make this change presently.

The attribute is mainly negative because VZ has brought a paradigm shift in working with road safety, however this shift has not been included in laws and regulations. The lack of suitable laws manifests itself as a deal breaker in the responsibility allocation for example. Moreover, the jurisdiction of roads is divided into several areas, being national, municipal and cities. There are numerous examples that rural municipalities have dangerous roads, but that the national body can't intervene in order to increase the safety as some municipalities want to maintain full authority and favor mobility over safety.

### 5.3 Conclusion

Answering the sub-question what are the factors that have contributed to the success of Vision Zero the following can be said. First, the factors that are mentioned are quite uniformly stated across the interviewees. Second, there is little difference between the factors that came direct from the question and from the coding. These findings suggest that a unified vision is present among the actors who work with the policy in that they regard the same factors as being contributors to the success of the policy.

Elaborating further on the success factors presented in this chapter a clear resemblance can be seen with quality systems and measures from medicine. With the introduction of the working methods that come from these industries, factors are introduced to create a more professional road traffic system. This can be seen from the most mentioned subject, the system perspective. Moreover, can it also be observed with the often-mentioned factors such as best practices, ethics, in-depth studies and the change in responsibility. Further are the increased cooperation and the willingness of other sectors and the society to contribute to the policy seen as factors that contribute to the success.

Other factors that should be taken up is that country-specific factors have a high importance for the Vision Zero to be successful and enable a good policy process. These factors are thus not specifically part of the Vision Zero policy but happen to influence the policy process and outcome on a positive way. One of these factors is that Sweden for example has a relatively small population with around ten million inhabitants and that the population composition is relatively homogenous compared to other and often larger countries. This makes vision sharing easier for a certain policy easier as less convergence is needed in vision sharing.

Besides these country specifics, there were certain key people that are highly regarded as having influence on the success of the policy. Both Claes Tingvall, major founder and later director for traffic safety at Trafikverket and Ines Uussman, the minister for communications back in 1996. Have had significant influence in establishing the policy and to get it backed up from the whole parliament. Several people in the interviews mention this as the right people at the right time and see it as an essential item in the development of the policy.

Likewise, cultural aspects also play a role in the development and success of the policy. First, it should be mentioned that safety is an item that is well integrated in Swedish society and in the wellbeing of people. So was Volvo already focused on safety before Vision Zero started in 1996. Furthermore, are other items in design such as wellbeing at work and design of furniture made in mind with safety as this enhances the wellbeing of people. Further is an informal business setting and well developed industry-government relations has also supported Vision Zero policy. This informal setting in combination with the concept of the system designer paves the way for the paradigm change for traffic safety. Therefore, these mentioned success factors specially apply to Sweden and should not be thought to be present in other countries or even contexts in Sweden.

Besides the discussion of the success factors the bringing down of fatalities and severe injuries, the policy has also been successful in making substantive changes in the work and routines that are part of the road traffic system and then mainly aimed for safety. Despite the lack of suitable

legislation and regulations that support the Vision principles, Trafikverket was and is still able to change norms and culture in the road traffic sector. Therefore, Trafikverket has used mostly soft measures such as increased cooperation, both political and social support and pressure, procurement for innovation and a systematic approach towards road safety to make some examples. It should however be noted despite the aforementioned analysis of Vision Zero's success, such a policy should not be considered as a prerequisite to make progress in the traffic safety sector. During the same period, The Netherlands for example has booked the same progress in reducing the amount of traffic fatalities, without using a mission-oriented policy.

## 6. Vision Zero in the light of the Weber-Rohracher framework

To see how the Vision Zero policy can be seen in the face of transformative change, the list of twelve failures from Weber and Rohracher (2012) is used as in table 5. As earlier mentioned in the theory chapter these twelve failures can be analyzed to see if failures are present in a transformative policy in the context of societal problems. As the Vision Zero policy is seen as a transformation in road traffic safety an overview is presented.

Policy	type of failure	Adressed in Vision zero
market failure	information assymtries	+
	Knowledge spillover	+
	Externalization of costs	+
	Over-exploitation of commons	+
Structural system failures	Infrastructural failure	+
	Institutional failure	+
	Interaction or network failure	-
	Capabilities failure	+
Transformational system failures	Directionality failure	+
	Demand articulation failure	+
	Policy coordination failure	-
	Reflexivity failure	+

Table 5 Weber-Rohracher framework applied to Vision Zero

First, the transformational systems failures will be addressed as these are deemed most important for the research in Mission-oriented Innovation Policy. To start with the description of the type of failure will be provided, this failure will then be reflected upon the Vision Zero policy. Also, a list will be provided in which attributes deal with certain failure types to get more context of how the vision Zero policy addresses the failures. The data that is used to provide answers for the reflections is based upon interview data and data retrieved from the coding process of the interviews.

### Transformational System failures

**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 corridors of acceptable development paths.

**VZ theory:** Directionality is ensured by different aspects within Vision Zero. The main driver is the double zero in the policy. The aim to reach zero severe accidents and zero fatal accidents in the road traffic system. This goal creates a shared vision among actors and the society because this goal is easily to relate to and ethically motivated. The coordination of the directionality is mainly done by Trafikverket, they are the main governing body that shares the vision across all actors and creates the publicity for the policy. Trafikverket is also the leading agency in the development of future goals and projects which often are done together with other actors such as NGO's or private firms. Both parties have historically been able to take time for the development as Vision Zero is a long-term commitment, because the policy will only be fulfilled as the double zero is reached, and therefore there is no need for short term solutions with temporary effects.

**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.

**VZ theory:** This failure is 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 learned this was however not the case. With the introduction of crash ratings, widespread questionnaires about traffic safety and political debates, it was discovered that a market for traffic safety exists. Therefrom the involved parties pushed for more safety features on items related to the traffic usage. Moreover, became Trafikverket active in stimulating and further creating the market for traffic safety. They did this by using procurement tools and using the government as lead example for taking safety measures. Further they actively informed users on how to behave safer and use safer equipment in the traffic system with items such as vehicles or helmets. A primary example of this is the EuroNcap crash test program. EuroNcap is a European program developed to test cars on passive and active safety and thereby setting scores. Sweden had in the initial phase of the development a leading role and utilized this upmost to create an awareness for safety in their society. By setting these scores buyers are informed over the

safety level of their cars and thus helping to form the market for safe transport. Besides these efforts that dealt with market demands, also other outcomes of demand can be observed. So is the passing of the Vision Zero policy in the parliament with support from all parties a sign of demand articulation. Since the members of the parliament are chosen by Sweden citizens' the passing of the vote is a sign that the Swedish society wants safety.

**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.

**VZ theory:** This policy coordination failure is the biggest problem of the Vision Zero policy and is causing problems in the implementation of the program in different fields. First, the multi-level policy is not fully developed. 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 and are not based upon the concept of system designers. The lack of suiting legislation to Vision Zero enables problems concerning implementation aspects and a wider interpretability of the policy as it is not bounded to the new system. Especially on regional levels this causes problems since these have their own responsibility of infrastructure planning. Since the regions often favor mobility over safety, roads with a higher amount of severe and fatal accidents are present on these regions. Trafikverket has however few legal measures to increase the safety on these roads. Further is coordination between European and national level of legislation difficult for a successful policy coordination. Since Sweden and Norway are the only countries that have introduced the Vision Zero examples on such a rigorous way, it sometimes hampers the development of their ideas, as implementation of safety items is not possible on national level since these are regulated on European level.

Considering horizontal coordination also weaknesses exists. Sustainability issues could be integrated into the Vision Zero policy like other environmental problems and livable cities. This is known by the people who are working with the policy, but thus far no real actions have been taken to integrate or set cooperation's with these other sectors to create a better system and come to better results. A thing that however is well developed is the coherence between the public policies and the private sector. On different levels platforms and agreements have been made on traffic safety to ensure information sharing and policy development where both parties can profit from.

**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, provide spaces for experimentation and learning; No adaptive policy portfolios to keep options open and deal with uncertainty.

**VZ theory:** This failure is well addressed in the Vision Zero policy. One of the main principles of Vision Zero is a learning attitude. This principle is funded by the thought that items of improvement first should be measured before they can be improved to make sure what the effects are of the policies or innovations that are introduced. This notion comes from quality systems and continuous improvement in the industry but is translated to suit Vision Zero policy. This means for Vision Zero that continuously the output of the system, which are the traffic fatalities and severe injuries should be measures in depth. Also, this translation implies that there is an ongoing search for best practices for the measures that can be taken for traffic safety in order to save lives in the traffic system. The yearly follow-up data is retrieved from multiple indicators that are measured every year to give insight in the state of the road safety which are directly linked to a statistical model that represents an amount of road fatalities. The before mentioned in-depth studies are also a part of this. Also have platforms been established to discuss developments in traffic safety on yearly bases, these platforms include stakeholders such as the vehicle industry or NGO's.

## Structural system failures

Structural system failures are thought to be addressed because the Vision Zero is already twenty years old and is based upon established agencies and networks that are even established for a longer time looking at the administrations that dealt with traffic regulations for example. But it nevertheless is interesting how Vision Zero holds against these types of failures and how they are addressed.

**Infrastructural failure:** Lack of physical and knowledge infrastructures due to large scale, long time horizon of operation and ultimately too low return on investment for private investors.

**VZ theory:** Infrastructural failures have been well addressed because multiple, well performing structures are present to perform work on traffic safety and share knowledge. Despite the very long-time horizon of the policy no practical obstructions are present considering the cooperation and support of NGO's and private parties. From the government there are two parts that deal with traffic regulations and safety: the road traffic administration (Trafikverket) and the road traffic agency (Trafikstyrelsen). The task of the first is mainly to engage in infrastructure planning and development, while the second is mainly engaged in legislative tasks concerning the traffic system. Besides these governmental bodies that are responsible for most of the infrastructure, also platforms such as SAFER exists that included parties from both private, governmental and academic level to share and development new knowledge.

**Institutional failures:** Hard institutional failure: Absence, excess or shortcomings of formal institutions such as laws, regulations, and standards (in particular regarding IPR and investment) create an unfavorable environment for innovation. Soft institutional failure: Informal institutions (e.g. social norms and values, culture, entrepreneurial spirit, trust, risk-taking) that hinder innovation.

**VZ theory:** All the laws that are imposed in the traffic system work well and don't cause externalities, they are however not well suited to the Vision Zero policy, mainly considering the allocation of responsibility that rest on the system designers. Looking purely at the institutional



failures it seems however to be well addressed and the problems seem to be more on the side of the policy coordination. Soft institutions are well developed and even seem the boost of the adoption of Vision Zero. The Swedish culture has a focus on safety, cooperation and social values which all favor the Vision Zero approach.

**Interaction or network failure:** Strong network failure: Intensive cooperation in closely tied networks leads to lock-in into established trajectories and a lack of infusion of new ideas, due to too inward-looking behavior, lack of weak ties to third actors and dependence on dominant partners. Weak network failure: too limited interaction and knowledge exchange with other actors inhibits exploitation of complementary sources of knowledge and processes of interactive learning.

**VZ theory:** A relatively strong network failure is present. While many things have been done to address this failure such as sharing platforms, yearly follow ups to discuss the performance and a strong drive for continuous improvement, a too inward-looking behavior was established. This behavior manifested due to several reasons, the foremost being the success of the policy. With a steady lowering amount of traffic fatalities each year, Trafikverket became the victim of their own success by not implementing enough traffic safety measures anymore and not developing new measures. Besides this problem pressure from politicians was low because good results were made, which further created a relaxed environment. The results of this can be observed in the last five years and especially in in 2018 as the amount of traffic fatalities went up with a high margin. Also play reorganizations a role in this failure. With reorganizations in Trafikverket and the police the workload has temporary been higher and several important traffic safety projects have been neglected.

**Capabilities failure:** Lack of appropriate competencies and resources at actor and firm level prevent the access to new knowledge, and lead to an inability to adapt to changing circumstances, to open up novel opportunities, and to switch from an old to a new technological trajectory.

**VZ theory:** The capabilities are well developed. Within Trafikverket there is a lot of knowledge on Vision Zero and how to deal with traffic safety, this was already from the start present. Moreover, is this knowledge also present by private actors and Trafikverket actively shares this knowledge with everyone in order to educate parties about the principles of Vision Zero.

## **Market failures**

Finally, we look at the classic market failures as rationales for innovation policy.

**Information asymmetries:** Uncertainty about outcomes and short time horizon of private investors lead to undersupply of funding for R&D.

**VZ theory:** Information is shared across actors and moreover is Trafikverket active in the gathering of information that is important for the traffic system. Besides these efforts are private parties well adopted to the long-term commitment of the Vision Zero policy. This has shown over the past 20 years since that they like to identify their selves with Vision Zero and thus aim for good results over the long run and do not focus on temporary short-term results or temporary measures.

**Knowledge spill-over:** Public good character of knowledge and leakage of knowledge lead to socially sub-optimal investment in (basic) research and development.

**VZ theory:** As a public body, the idea from Trafikverket is that as much information as possible spills over towards others in order that traffic safety can benefit from it. This already initiated in 1959 when Volvo started with the sharing of the patent of the safety seatbelt. This was not the only time that Volvo has shared their intellectual property rights in order to increase safety over financial gains. The government has helped along Volvo by doing this with their knowledge and creating and further developing the market for safety which in the end resulted in an improved safety for cars but also other aspects such as helmets or alcolocks. To this date Swedish industry and Trafikverket make efforts in further market developments of safety and knowledge sharing.

**Externalization of costs:** The possibility to externalize costs leads to innovations that can damage the environment or other social agents.

**VZ theory:** The item of externalization of costs is a widely discussed item in Vision Zero, especially in the beginning. Opponents of Vision Zero state that the striving to zero deaths in traffic safety is overly expensive for society and the money could be more efficiently allocated towards other societal problems where more lives can be saved. This argument is however largely debunked as Vision Zero policies and innovations have a much higher efficiency in live saving looking at costs. Also have technological developments and items like addressing high priority sites made sure that lives can be saved with little extra costs.

**Over-exploitation of commons:** Public resources are over-used in the absence of institutional rules that limit their exploitation (tragedy of the commons).

**VZ theory:** One could argue that considering traffic safety here is an over exploitation of commons. As users use the traffic system on such a way that it results in fatalities. But since these fatalities don't results in significantly negative results on society, that there is no lack of institutional rules and the traffic system is not based on natural resources, what is something usually seen in over-exploitation of the commons. It is not useful to address this as a failure within Vision Zero.

### **Can Vision Zero be improved?**

From the reflection of the framework of Weber and Rohracher (2012), two failures stand out as being in adequately addressed in the Vision Zero policy: policy coordination failure and a network. Although the policy is successful in dealing with traffic safety and has brought substantive changes in society, these failures limit the full potential of the policy. Hence policy advice will be provided in the way how these failures could be addressed and what measures should be taken to deal with these failures.

### **Policy coordination failure**

The policy coordination failure is mainly based upon the issue that there is no suiting legislation that is part of the Vision Zero policy. With the introduction of the policy in 1996 a paradigm shift was created in society to change how actors and society should view and deal with traffic safety. Regulations and legislation about traffic safety was however not adapted to follow this paradigm shift. Trafikverket already knew for the beginning that old regulations would not work in their advantage and have tried multiple times to initiate changes from politicians or other governmental bodies, but these have thus far not been successful.

Since these measures have not worked it would be good to lift upon the momentum of the increased amount of fatalities in Sweden. The large increase in traffic fatalities in 2018 has shocked not only Trafikverket but also politicians. Besides the increase it is also known that a fair amount can be attributed to head on collision with heavy traffic. With the increase in fatalities more pressure is present to address the legislation, and with all the data that Trafikverket has it also possible to start with small, targeted changes that address the largest problems such as the head on collision with heavy traffic.

Besides this national momentum building action, the actions can also be taken on international level. The rise in road traffic fatalities is not a unique case for Sweden, The Netherlands, Germany, The United Kingdom and Finland also saw their road traffic fatalities increase in 2018 (CBS, 2019) (Dhani, 2018) (Smith, 2019) (The Local DE, 2019) compared to the previous year. Although there are also countries that made good results such as Belgium and France the first mentioned countries could team up to build momentum on European level to put road traffic safety on a higher agenda. Since these other countries don't follow the same policy as Sweden in the Vision Zero principles, still significant measure could be taken. So could regulations on Trucks be adapted on European level to deal with the head on collisions.

### **Interaction or network failure**

The interaction and network failure can partly be addressed by the lack of efforts that Trafikverket has made to address safety in the road traffic system. Because in the past years the results looked promising and in line with the expected numbers a relaxed stance towards taking measures was established. This not only can be said for Trafikverket but also for politicians and other traffic related organizations such as the Transport styrelsen that is more responsible for the development of legislation compared to the more practical role of Trafikverket. While the necessary networks and sharing platforms where and are still present to get information at the right places the failure still occurred and could also be related to a new type of failure that will be addressed later in the report.

To prevent a failure like this in the future it would make sense to extend the systematic perspective of Vision Zero to the highest level possible. By creating a council with highest level representatives from involved parties in the road traffic system an oversight could be established. Parties that should be involved would be the Minister of infrastructure and Economic affairs, Director from the Police, Trafikverket and Trafik styrelsen to name the most important ones. This council could then discuss present problems and future challenges that they see ahead. With the information these actors have, problems can be solved jointly to minimize possible externalities, and plan ahead of measures that negatively influence traffic safety. A reorganization of the police has for example resulted in a temporary decline in enforcement on the road. In this council such a reorganization can be made clear beforehand and then measures from other parties can be taken that temporary could solve this gap in enforcement.

## Reflection on the Weber-Rohracher framework

Because this research is based upon abductive ways of conducting research and thereby uses the list of twelve failures that are presented by Weber and Rohracher (2012) it is also important to critically assess this framework. Likewise, the authors of the framework state that it can be improved stating that: *'thorough methods and criteria need to be devised to assess whether in particular the four novel types of failures really represent a problem or not. A series of empirical studies, aiming to study the occurrence and magnitude of such failures should be launched. This empirical work should go hand in hand with a refinement of the concepts and definition suggested of what constitutes a failure in the context of long-term transformative change.'* (p. 1046)

As a first observation, the Vision Zero case makes clear that policies can be successful even if not all failures are adequately addressed. This makes clear that the Weber-Rohracher framework should not be taken to mean that all failures need to be 'fixed' for a policy to be a success. Instead, it is better understood as a list of issues to check, where adequate policy design in some dimensions may compensate for a lack of attention to other dimensions.

The general critique that can be made on the framework concerns the contextuality. As can be seen earlier in this chapter the framework is well usable and delivers proper results in the context of transformational change, it however lacks content in the way of what kind of problem one is dealing with in general. Analyzing all the twelve failures provides an understanding of where possible problems are in transformative context but could lack contextual aspects that give a better understanding of the aimed transformation and the landscape it is located in. Currently in the model all the context should be provided on an additional way, but could be very well integrated.

A way to enrich this context is to add an additional part that describes the context of the transition. This part should be able to provide extra information about the situation of the

nature the transformation has. An example of such an approach can be found in the article of (Wanzenböck, Wesseling, Frenken, Hekkert, & Weber, 2019). It reasons from both the wickedness of social problems and the wickedness of innovative solutions. Combining these features the authors come up with four different problems solutions in order to contextualize missions. These four states of the transition are: 1. Disorientation, 2. Problem in search of a solution, 3. Solution in search of a problem and 4. Alignment. Most of the transitions start at disorientation to take a pathway in order to reach alignment and thereby using one of the three possible pathways.

Such a framework provides more context and could be attached to the current Weber-Rohracher framework of twelve failures. In such a combined framework more context is provided upfront making the model broader and therefore the outcome of the twelve failures can be put better in context and provide a more specific policy advice. In particular, one can start with outlining the views on the problem and the views on the solutions for the transformation as a context, and only then check the twelve failures.

Looking more at the specific failures and problems regarding in the Vision Zero policy, the Weber-Rohracher framework would lead one to conclude that there is a network failure. What happened is that due to years of good results, an inward-looking behavior was established and not enough new measures were developed and implemented to solve current problems. The outcome of this is that the traffic fatalities have declined at a lower rate in the last few years and that it even went up last year. Here, however, the notion of network failure may fall short in capturing the process. As mentioned, it is more that the very success of the policy created a too relaxed and self-satisfied environment, not only inside the policy program, but also how it was perceived from outside as political pressure to perform went down. So, this failure in the Vision Zero process cannot be fully explained by a too intensive cooperation as described by network failure. One could argue that it maybe could fall under a capabilities problem since the capabilities for addressing problems is present at Trafikverket. Hence an outcome can be matched with one of the 12 failures, but the origin or failure mechanism of the problem is

different. From the description provided above with the failure that is happening in the Vision Zero program a new failure has specifically be developed that addressed this kind of failure. This proposed failure is called here the ***Momentum failure***. The failure is specifically relevant to long-term programs regarding mission-oriented innovation policies. Such programs are not only developed to deliver transformations and change from a certain regime in society but are also present to keep developing best practices and to deal with new challenges that might emerge after the transformation. Since this for Vision Zero is already present for twenty years many efforts have been made for the development of the policy and addressing failures.

This momentum failure therefore is a failure that would be mostly applicable at policies that are already somewhat developed and established in society. The failure that is happening is that the momentum of the mission is lost or severely declined. With a downfall of the momentum all kind of measures can be present that ensure sufficient Reflexivity and vision sharing, but due to promising results, the need for ongoing experimentation and new measures is slowly neglected. Looking at the failure class it best can be described to the transformational failures. A momentum failure can then be described as a lack of ongoing experimentation and new measures due to good results in the past. When external factors (suddenly) change it becomes clear that too few measures have been taken despite that all the necessary mechanism and platforms for dealing with reflexivity failures are present.



## 7. Vision Zero Transfer

The success of the Vision Zero program in Sweden has not remained unnoticed and several other countries and governmental bodies therefore decided that this approach also could improve their road traffic system. With the aim to decrease the amount of traffic fatalities and severe casualties Vision Zero policy has been installed. This has led countries like Norway, provinces in Australia, several large cities in the United States and London to implement a form of Vision Zero policy. 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.

For this research it is crucial to see how the Vision Zero policy is transferred to other countries and to other sectors within Sweden as to analyze if the success factors that made the policy successful in Sweden also matter in another context. Further it can be discovered what kind of other problems can occur when dealing with the mission of Vision Zero when dealing with other contexts. In this way, we can investigate the transferability of Vision Zero policy.

This chapter starts with a description of other countries besides Sweden that implemented a Vision Zero style traffic policy. Thereafter it will be discussed what the similarities and differences are with the Swedish Vision Zero and the success of respective the policies. We then look other sectors where Vision Zero style of policy has been implemented in Sweden.

### 7.1 Vision Zero in other geographical sectors

Since the introduction of Vision Zero in 1997 the policy has received a lot of attention in the traffic safety sector. The attention for Vision Zero did however not only come from the success of the policy and the unique approach, Trafikverket was also active in sharing and promoting the policy in an international context such as on conferences on traffic safety.

The country that copied the most principles of Vision Zero is Norway. The 'Vision Zero' plan was introduced in 2001 in the national transport plan of 2001 (Communications, 2000). Although no reference is made to the Swedish Vision Zero policy in the Norwegian version, the policy is very similar. This means that the goal of the policy is to function as an all-compassing framework for road safety that completely transforms the system. One difference is that the policy was not as politically supported as the Swedish vision. Elvik (2009) made an analysis of the Norwegian Vision Zero and compared it to the Swedish Vision Zero policy and made several findings that will be presented in the next section

One of the most important statements he makes is that not all the actors involved in the policy have a shared vision in what the Norwegian Vision Zero should do. Therefore, the vision suffers from a considerable interpretative flexibility due the fact that the government has not succeeded in creating a shared vision among actors. A reason for this is that the government was mainly busy in articulating the ethical aspects of the policy, while the road administration was mainly engaged in how it practically would change their way of working. Resulting in that both parties worked past each other and no shared vision was created. Besides, it is stated that the Norwegian government has relaxed the vision over time as it no longer supports the statement that safety never should be traded for mobility. Moreover, there has been a lack of involvement of societal actors during the transformation.

Elvik (2009) therefore concluded that the Norwegian policy does not resemble Swedish policy since there is no shared vision among actors and that it does not function as an overarching traffic safety system. Likewise, the policy package has not been as systemic as in Sweden. Nevertheless, it can be argued that the Vision Zero approach in Norway is not a failure per se as it has increased cooperation among governmental actors working on traffic safety and that strategies are becoming more concrete over time (Elvebakk & Steiro, 2009). To the exact effect is hard to establish, it is worth noting that the number of traffic fatalities in Norway because the number has declined from 244 in 2006 to 135 in 2016 (Sönnichsen, 2019). Considering this number, the policy has succeeded in its goals as it has almost halved the number of fatalities in

10 years and kept Norway's position as country with the least traffic fatalities per inhabitants. Quite interestingly, as in Sweden, traffic deaths rose in 2018 for Norway, albeit with only one percent (Statistics Norway, 2019). A reason for the good safety track record of Norway could also be attributed to the new vehicle fleet, as Norway heavily subsidize electric cars. Therefore, currently half of all new cars sold are electric and 10.7 percent of the fleet is consisting out of modern electric vehicles which all are frontrunners in safety (Lefteris Karagiannopoulos, 2019).

In Australia, Vision Zero has been implemented since 2004 with the introduction of the 'Safe System' policy. This policy combines elements from Vision Zero and the Dutch Sustainable Safety policy. The policy is however only implemented in the states of: New South Wales, Victoria and West Australia, representing around 68% of the total population. have conducted efforts to limit traffic fatalities and severe injuries (Mooren, Grzebieta, & Job, 2013) (Gargett, Connelly, & Nghiem, 2011). The main challenge in Australia lies, even more than in Norway and Sweden in the large geographical area with a small amount of population. Therefore, the four main pillars of the policy are 1. The limit of human performance, 2. Limits of human tolerance to violent forces (design vehicles to protect humans to common crash types), 3. Safe road use, 4. Creating a forgiving road transport system (Mendoza et al., 2017).

Despite the fact that these aspects are similar to the Swedish policy, the policy in Australia and its provinces are display numerous differences from Vision Zero (Mooren et al., 2013). The policy in Australia not widely supported politically on a national level as traffic safety fall under the jurisdiction the Australian states. Besides are the used road and traffic engineering standards in Australia based upon US standards and not on the safer European standards. Also are unsafe driving speeds culturally more accepted than in Sweden or other European countries. Therefore, it is stated that Australia still has a long way to go. Since the implementation of the policy the traffic fatalities have decreased from 1584 in 2004 to 1225 in 2017 (Department of Infrastructure, 2017). Therefore, is stated that the system brings results, but not as good as Sweden or Norway. The authors state that this is due the patchy implementation of the Safe System policy.

The UK has a history of rigorous traffic safety programs which have brought good results but did not include system approaches or ethical standards. Therefore, the government has not made a nationwide policy out of it. Yet, several large cities, including London, have recently started using a Vision Zero approach, even if the concept of Vision Zero has been discussed since 2006 (Whitelegg & Haq, 2006). As of 2018 London has launched a policy containing the action plan to reach zero fatalities in 2041. With the following foci: Safe speeds, Safe streets, Safe vehicles, Safe behaviors and Post-collision response. Besides these general safety measures London tries to transform the road safety system as has been done in Sweden. The government of Greater London want to implement a safe system approach containing the three principles: people make mistakes and the transport system should be able to forgive them, the transport systems should be designed to cope with the physical limits of violence a human body can tolerate and at last the concept of system designer should be implemented. This manifests itself in a practical way that the whole speed limit system in the London greater area will be adapted. As all the roads in the London greater area fall under their own authority they are able to make a huge difference in implementing this policy (Transport for London, 2018).

The United States have historically always been a leader in traffic safety and were the safest country regarding traffic deaths per inhabitants in the 1970-s. This has however changed for the worse as of 2017, it currently ranks 18<sup>th</sup> in traffic fatalities per capita. Especially high risk groups such as children and elderly are relatively higher exposed to incidents and fatalities than other OECD countries (Mendoza et al., 2017). To lower these numbers and give more protection to high risk traffic participants such as pedestrians and cyclists in an automotive focused country is still one of the biggest challenges. Since the federal government in the United States is not purposed with traffic safety, many large cities and several states have chosen for a Vision Zero approach. In total 16 large cities have introduced Vision Zero policy since 2016. In the states that have implemented Vision Zero style policies fatalities rates have dropped 25% faster than states did not (City of New York, 2014).

New York City introduced the policy in 2014 and already in 2015, a record low number of fatalities was measured with a twenty seven percent decline in pedestrian deaths. Since the implementation already 102 corridor and intersection projects have been made. It is however remarkable that one of the Vision Zero measures included tougher sentencing of people that break traffic laws (Mendoza et al., 2017). According to the Swedish principles the focus should be made on humans that make mistakes and that the infrastructure should be adapted to cope with those mistakes. Tougher sentencing of road traffic victims thus contradicts the Swedish principles.

In San Francisco, a Vision Zero Policy also has been established in 2014. Together with the Department of Public health, the city has been looking after the causes of fatalities and severe injuries first to determine the causes of the fatalities and severely injured. It was determined that the largest contributor to fatalities were large trucks and busses. As they were involved in four percent of all traffic collisions but responsible for seventeen percent of all fatalities from 2007 to 2011 (Ibid). Therefore, measures have been taken to address issues regarding training and side guards for trucks. Besides, 24 priority projects have been launched in two years as well that speed limits were lowered and automatic speed control was installed. Also have pedestrian improvements been made with the help of public input in order to analyze the highest priority locations and come up with solutions together (Ibid).

Vision Zero has also faced problems in the US. In particular, in Los Angeles, the city with the most traffic related deaths in the US, Vision Zero implementation has proven difficult from the start. Since there was no history in the city with a traffic safety policy, the complete system had to be formed which created confusion among actors and did not result in a shared vision (Ibid).

In the Netherlands, a new strategic plan was launched in 2018 for traffic safety 2030 containing a Vision Zero concept (Ministerie van IenW, Ministerie van JenV, IPO, VNG, Vervoerregio Amsterdam, 2018). Historically the Netherlands has been using a systematic traffic safety

approach for road traffic safety, but it never used a vision zero before. The policy document states that the Netherlands want to be more ambitious regrading traffic safety and that it also wants to have the same goal as the European Union in having zero traffic deaths in 2050. However in the document is mentioned that a real zero would be unrealistic and that there always should be a right mix between safety and freedom in the traffic safety, which a step less ambitious than the principles that the Swedish principles state that: *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.* As can be seen in chapter four. Besides the aforementioned steps, it is aimed to strengthen the relations with NGO's and private parties to reach the goal of zero traffic deaths in 2050.

An overview of the implementation of Vision Zero can be seen in table 6 which is an adaptation from (Mooren et al., 2013). It can be observed that only in Sweden high political involvement was present with the adoption and further development of the policy.

Country / City	Sweden	Norway	London	Australia	New York	Netherlands
<b>Aspects</b>						
<b>High political involvement</b>	Yes	No	No	No	No	No
<b>Shared vision among actors</b>	High	low	low	Low	Low	Not implemented yet
<b>Active NGO legitimacy creation</b>	High	High	High	Low	High	Not implemented yet
<b>Funding commitment</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Safe system policy</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Nation Wide implementation</b>	Yes	Yes	No, city wide approach	No, patched were states take a lead role	No, city wide approach	Yes
<b>Year of implementation</b>	1997	2002	2018	2004	2012	2020
<b>succesfull</b>	Yes	Yes	Not proven yet	Partly	Partly	Not implemented yet

Table 6 Vision Zero in other countries

The lower involvement of higher politics in some countries compared to Sweden can be attributed to different styles of governing. So have the United states and Australia a governance model where local states and provinces have much more responsibility and power when it

comes to legislation. Therefore, these types of policy are often left to lower authorities instead of national government organizations. Furthermore, could the argument be made that creating legitimacy is less needed since Sweden has demonstrated that the vision works for their country and therefore the belief is present that the policy is proven, although this doesn't necessarily apply to other countries as well.

In most countries that taken up the Vision Zero concept, a lack high political support translates into a lack of shared vision. The absence of a unanimous vision from the highest legislative bodies leaves room for different views and opposing parties. Besides the lack of support have countries such as Australia and the United States a much more conservative vehicle lobby that promote the freedom of car usage. This also can be seen in the work NGOs put in the vision, as these is lower in both the before mentioned countries compared to Sweden.

Most countries have thought through the funding of the Vision Zero policy, as money is needed to facilitate the transformation to Vision Zero principles and to build new infrastructures. Yet, it often seems to be an approach that is more centered about building safer things with same amount of money as to come to a more cost-effective spending safety ratio. This is of course not a necessity as Vision Zero principles are not centered around cost-benefit ratios. Still, it may help to spend government money on better ways.

The system approach underlying Vision Zero is taken over in every country, although not as rigorously as in Sweden. This could be attributed to the recent implementation of the policies. As already mentioned only Sweden and Norway have adopted the Vision Zero nationally, whereas the other countries have a more regional or city wise approach to the vision.

Considering other countries that implemented a type of Vision Zero policy the following can be concluded. First, the creation of legitimacy and for sharing the Vision across society seems an important aspect in the implementation of Vision Zero policy. It seems that countries such as the examples in the cities in the United States and in Australia show that there is no shared

vision among actors and society. Due to a more diverse society and a lack of legitimacy for the vision from higher political levels the policy is not able to get a foothold regarding transition via soft power. Looking at Norway the government has not made strong efforts to ensure legitimacy in the way to create a shared vision among societal actors, despite having success with the policy. Factors as a small homogeneous population that is centered around one large city, Oslo, could be a that legitimacy is less important for Norway.

If we look at cities that implement Vision Zero the following can be highlighted. Despite that this is the lowest level of government where the policy is implemented, it is often more successful. Regardless of the short time cities like New York and London are using the policy, they seem successful in what they aim to do, lowering the amount of traffic fatalities. Relating to what is happening in Sweden, as is happening in their cities, is that large cities have significant autonomy over road regulations and infrastructure design. Thereby they are less dependent on other, possible higher authorities that need to adapt legislation in their part.

In Sweden this can be seen as well in the city of Gothenburg. This city is using their own Vision Zero policy and since they have almost authority over all their roads regarding legislation, they can implement all the necessary measures they want, and believe are necessary. Besides this, a more powerful implementation situation is created where cities are diverse in traffic modes and high in traffic flows, thereby the effect of measures taken to improve traffic safety will be mentioned earlier in time and in higher magnitudes than on national roads.

## 7.2 Vision Zero in other sectoral sectors

Besides the success of Vision Zero in the road safety sector and its duplication in other countries, the policy is also copied in other sectors. This is done because the new paradigm of Vision Zero is promising to develop zero death policies and safety systems in other sectors (Zwetsloot et al., 2017) (Atkins & Granhed, 2012)(Kristianssen, Andersson, Belin, & Nilsen, 2018). Sweden was the first country to implement the policy in other sectors, and started



implementation in the mid to late 2000s. Moreover, it also gained interest in other countries and global organizations. Kristianssen and colleagues (Kristianssen et al., 2018) made a comparative content analysis over the application of Vision Zero in four other sectors than traffic.

The mentioned publications are especially interesting looking at how Vision Zero is adapted in order to suit other challenges that have both societal and industrial aspects. Since an important goal for this research is to see what Vision Zero can contribute to MIP, these translations towards other sectors are able to give valuable insights into the power of Vision Zero policy to deal with societal problems. In Sweden the approach has been used in the following sectors: fire safety, suicide prevention, patient safety in healthcare and workplace safety. An overview of the analysis can be shown in figure 4 that is taken from Kristianssen et al. (2018).

**Policy content**  
↓

	<b>Policy decision</b>	<b>Policy problem</b>	<b>Policy goal</b>	<b>Policy measures</b>
<b>Road traffic safety</b>	Parliament decision	System design, humans and human body not infallible	Eliminate deaths and serious injuries  Interim and effect goals	Focus on safe and supporting vehicle and road design, coordination
<b>Fire safety</b>	National guidelines, government request	Individual	Eliminate deaths and serious injuries  Interim and effect goals	Focus on information, local measures, technology
<b>Suicide</b>	Parliament decision	System design	No one should have to commit suicide  Effect goals	Focus on information, coordination, knowledge-creation on the national level
<b>Patient safety</b>	National guidelines, government request	System design	Eliminate deaths and serious injuries  Effect goals	Focus on coordination, increasing knowledge on national, regional and local levels
<b>Workplace safety</b>	Parliament request and government decision	System design and corporate responsibility	Eliminate deaths and accidents  No interim or effect goals yet	Focus on coordination, education and communication on the national level

Policy area →

Figure 4 Vision Zero in other sectors (from Kristianssen et al., 2018)

The Vision Zero policy for fire safety was implemented because the forgoing policy was not bringing proper results besides that the policies' process was not properly under control. The intention of the policy was mainly aimed to solve the struggling policy process and lower the

fatalities. The main measure to solve the policy problem was to setup a national cooperation from various sectors and levels that have the goal to make progress with a wide, multi-faceted and long-term preventive work. Actors from national, regional, local and domestic levels were included. Another focus is included in the new policy is a focus on vulnerable groups and environments, as most incidents take place due to smoking, arson or stove related fires. Despite these Vision Zero principles, the policy states that individuals themselves still have the most responsibility in dealing with accidents. When a situation arises that the individual, possible with help of others can cope with a situation, public authorities have a responsibility to intervene. Therefore, there is still a paradigm of blaming the user, while minor concerns are being outed about forgiving environments.

The policy measures that are being taken consist of four facets. The first one is about knowledge and communication where the aim is to inform risk groups such as elderly and children. Technical solutions are the next category that concerns items such as smoke detectors and new innovations products as self-extinguishing cigarettes. Local coordination and cooperation are emphasized to create more responsibility of local fire authorities and to identify which locals are at risk for fire in the domestic environment. The last area concerns evaluation and research, this item is mainly present to make sure that the vision does not become too wide and that focus is maintained on vulnerable groups and environments as well that it remains a multi-disciplinary effort.

A new suicide policy was developed, because the number of yearly suicides was too high (1500 a year) and the approach focused too much on the individual. This decision for a new policy was a parliamentary decision and is therefore politically supported from the highest level. This was not a smooth process, as the Swedish parliament wanted a new policy for suicide prevention in 2005 the Public Health Agency of Sweden and the National Board of Health and Welfare came with a national strategy in 2006 instead of a Vision zero strategy that was initially proposed by the government. In 2008 the government however chose for a Vision Zero. For this policy no consensus was present regarding the use of a Vision Zero goal as it was argued that a more

specific effect goal would suit the policy better. Despite these arguments the government went ahead with the Vision Zero and has since set up coalition of actors to gather and spread information on suicide as well as to set up measures to prevent suicide. With the new Vision Zero policy a system of preventive measures are implemented to make sure that targeted people are less at risk to become suicidal, have less access to suicidal means, increase care for suicidal people and to learn from past events.

Vision Zero for patient safety was introduced in 2010 with the aim to lower the injuries that people face in the Swedish health care system. The new policy was developed because in 2008 a government inquiry found out the existing legislation was not adequate to ensure patient safety. This problem concerns 100,000 individuals each year which is around 9 percent of the patients that are treated in hospitals. Moreover, it was discussed that the responsibility of each actor should be stated to increase awareness, as this is a source of problems. With a long-term vision that can address the failures made in leadership and structure as well as unclear routines and regulations working with individual health care. Also taken up is the notion that people make mistakes and that the infallible human does not exist and therefore the environment needs to be adapted. The long-term vision comprises of five measures are: Patient-focused culture within health care, patient participant in the received care, reduction of the number of frequent or serious health care injuries, the right knowledge at the right time and increasing knowledge about effective measures. The implementation was carried out on both public and private hospitals with a focus on evaluating, learning and the right qualifications.

Vision Zero for the workplace was initiated in 2016 after the number of work-related injuries and periods of sick leave were increasing. Moreover, there is a significant gender segregation in the fatalities that occur in Sweden. This is due to different sectors men and women are employed in. Another problem is the growing number of sub-contractors leading to unclear chains of responsibility and risk of human error. Besides the government wants that all accidents should be reported to the Swedish work environment authority. The Swedish government wanted to invest more in research and education related to this area, to make sure

that all accidents were reported and to produce suggestions to reduce bullying in the workplace. The plan is to form a wide coalition of governmental actors to bring clearer information and control about risks in the workplace, furthermore this policy is also aimed at risk groups, such a people working in forestry.

To see what these articles have in common looking at the conclusions is that the policies want to use a vision zero as an ethical standpoint and to divert from the old cost-benefit approach in safety. With the articulation of an ethical mission a greater drive should be created for missions which should lead to greater cooperation and the implementation of measures that have bigger effect than measures that have been implemented before. Moreover, the change from victim blaming for accidents towards the notion that people make mistakes and the environment should be adapted for it. This is not always as strongly articulated as with the traffic safety vision it is still a mayor part of the Vision Zero policies. This often comes together with the systematic perspective of dealing with the problem and to more professionalize the way of working with measuring the problem and finding targeted solutions. Also is it seen that the policy decision stems from discontent in all the sectors. There are reasons that dissatisfy the authorities and therefore it is thought that vision could be a good solution for the problems.

Kristianssen and colleagues (Kristianssen et al., 2018) come up with several observations across the cases. First, they see that the goal formulation and the description of a systems approach are mostly copied. Decision making, measures, actor inclusion and administrative routines have many different forms among each other and from Vision Zero. While the policies state that they work the same as the road safety policy, the same systemic and grounded work of designing the policy are lacking. Furthermore, they put forward the question 'Can and should Vision Zero policies be implemented in different types of policy areas?' They state that it remains unclear why the government introduced a policy in workspace safety while the fatal accidents were clearly decreasing, and that Vision Zero could be a temporary trend. They state that a possible explanation could be that moral principles of a Vision Zero policy apply regardless of trends and that it is easier to commit to international agreements. The article finalizes with a list of criteria

that are needed to set up a Vision Zero style policy in the context of personal safety and injury prevention.

*-Recognition that a clear definition of the policy problem is a necessary prerequisite in order to enhance measurability which in turn alleviates a long-term documentation of both the problem and progress made. This link between all parts of a policy process can enhance the ability to reach both short-term interim goals as well as long-term goals. (p.268)*

*-Access to solid empirical data on the magnitude and historical development of the problem at hand. (p.268)*

*-Access to a range of feasible hard and soft measures, including engineering approaches that enable passive safety strategies that compensate for human mistakes. This implies that measures on both a systems level and related to human behavior are implemented alongside each other. (p.268)*

*-Access to realistic strategies to control the problem, including system conceptualization, identification of key Actors, program theory and evidence-based measures on single sub-problems. (p.268)*

*-Application of a long-term working process in accordance with generic principles for continuous improvements, including surveillance, analysis, innovation, implementation and evaluation. (p.268)*

*-Assignment of leadership, authorities and resources sufficient for successful policy implementation and sustainability. (p.268)*

In the article (Kristianssen et al., 2018) nothing is being said about the success of these policies, probably because they are recently introduced and therefore not yet fully implemented or measurable. From the interviews it however became clear that the policy for fire prevention is not very successful, but the policy for suicide prevention is. However, multiple interviewees did not credit the policy itself for decreasing the number of fatalities.

Regarding the transferability of the Vision Zero policy towards other sectors, the interviewees also stressed the ethical stance is key for transfer. With an ethical approach, policy can diverge from the previous cost-benefit account regarding fatalities. Apart from the ethical logic, few similarities between the various Vision Zero policies were highlighted. So is stated that the new policies strive to have a system perspective but that they still are far from how it is designed in the traffic policy. The nuance should be provided that the traffic policy is already used for more than twenty years and the others less than five, but nonetheless the difference is there.

The fire prevention and the hospital prevention safety policies not fully taken over reallocation of responsibility and still have a heavy focus on victim blaming when it comes to accidents. This is also partly because of legislation that hinders them from making that transition. Equally, with the traffic policy where legislation is not adapted it gives also problems in other sectors. The main difference is however that where in the traffic policy Trafikverket uses other measures and tools to reach targets, for the other sectors legislation is actively them to do so. Having said this, it is also noteworthy that little action is taken to look into other measures and try to see what can be implemented within the boundaries of current legislation.

There is more than legislation that hinders a successful implementation. With the traffic policy it is mentioned that besides it is a long-term ethical goal it also is a strategy to create change in society and to make a transformation to a safer system. This wider strategy is lacking in all the other sectors, where there are only few other measures taken. It is said that this is due the fact that a lot of research has been conducted in traffic safety and at Trafikverket they know what measures to take to make the system safe with margins to 90 percent. They are able to do this

as the policy is backed up with scientific principles and always best practices are known and often used. This is much less the case for fire prevention or suicide prevention. In these sectors there is much less scientific evidence present to take measures that can make contributions to the system.

To conclude, it seems quite difficult to completely take over the Vision Zero policy in other geographical or sectoral contexts. The mode of governance an important factor that distinguishes the Swedish traffic safety sector from other contexts. In countries that are larger in population and more diverse social beliefs it becomes more difficult to legitimize and implement the policy. It hinders the establishment of shared vision among stakeholders and with the wider society. As a result, less momentum is created and the chance for successful measures becomes less. Furthermore, the long-standing and trusting relations that Trafikverket has with private firms and NGOs, and the way they cooperate, is difficult to copy in other contexts. The open style of communicating and high concern for safety seem items that are contributing to the vision but prove difficult to transfer in other contexts.

Looking at the other sectors it seems difficult to take over the policy package as a set of measures. Furthermore, it is more difficult to map the causes and trends of incidents with a fatal or severe outcome. This makes it more difficult to work with the policy because it is more difficult to learn from mistakes and target the most severe problems. Despite that not all aspects from the traffic policy are transferred in the analyzed cases, success nevertheless can be reached with the used policies.

## 8. Discussion

This research focuses on a single case in MIP, the Vision Zero program in Sweden. An abductive research method is used and therefore the generalizability of the research and findings should be taken in account. With the abductive approach the points most likely to strengthen MIP are the strong points extracted from the Vision Zero policy, hence the current MIP literature is verified with a practical case and looked what findings could be added from the Vision Zero policy.

Regarding the interview data it can be noted that all key stakeholders have been included. However, all interviewees were engaged with the policy on positive ways. This means that the people are professionally engaged with the policy and have a mostly positive view on the it. There are also actors who have consciously chosen not to use, or even oppose the policy. These actors could be an interesting additional source of information because they can reveal reasons where vision sharing, or policy measures fail in the process of taking them aboard of the policy. However, these actors are not interviewed as they are not engaged in the policy process and are therefore more difficult to reach than those who are. Besides that there was a limited time scope for the interview process, hence opposing actors have not been approached since the information that they would contribute would be far less than experts in the field of Vision Zero. Despite missing these alternate views in the interviews, a wide range of actors are covered that also include academic actors that should have an objective view on the policy.

To further build upon this work, future research can proceed in two ways. The first is to replicate the study and take up the traffic policy in other geographical contexts. While several studies have been conducted to compare the Swedish policy towards the one from Norway (Elvebakk & Steiro, 2009) Australia (S., L.B., & S., 2011)(Mendoza et al., 2017), the United Kingdom (Mendoza et al., 2017) (Whitelegg & Haq, 2006) and the United States (Luoma & Sivak, 2014) they are not performed in the context of MIP. This also applies to other sectors where Vision Zero is used outside the domain of traffic safety. The article of Kristianssen and



colleagues Kristianssen et al. (2018) delves into this matter, but lacks an Innovation science perspective and therefore is suboptimal to reflect it to MIP. A second way to proceed is to replicate this research design in other mission-oriented policies not related to Vision Zero. These cases can strengthen MIP in general like the Vision Zero case and the cases could learn from each other as well.

Regarding the practical implications, the following aspects can be elaborated. Foremost, the results of this thesis can help Trafikverket strengthen their policy. This thesis approached the policy from an innovation science perspective and therefore brings unique insights for Trafikverket. It does not only expose some weak aspects that the actors involve may want to improve, it also informs other organizations that aim to copy (parts of) the Vision Zero (including the Vision for 2030 of the Dutch Ministry of Infrastructure and Water Management). At last the, society can learn from this thesis as it shows a transformation into a more sustainable and safer way of transportation.

## 9. Conclusion

During the last decade, Mission-oriented Innovation Policy (MIP) has experienced a revival. Rather than focusing on technical missions as in the past, the new wave of MIP focused on the grand societal challenges of the 21<sup>st</sup> century, such as climate change, obesity and ageing (Foray et al., 2012). These new Grand Challenges differ from other policy problems that they are highly wicked in nature and therefore not easy to solve (Rittel & Webber, 2013). Existing innovation policy rationales based on market failures and system failures approach do not suffice. These policies are aimed to boost economic growth and are undirected in solving particular challenges. Instead, MIP can reason from transformational failures, including a lack of directionality, demand articulation, reflexivity and policy coordination (Weber & Rohracher, 2012). These failures guide strategic innovation policies that are aimed towards solving a societal challenge.

The call for MIP for societal challenges is a recent one, and very few examples of MIP exist. One policy dating back to the 1996 is the Swedish Vision Zero program, which aims reduce the amount of traffic related fatalities and severe injuries to zero (Riksdag, 1996). The policy has found its inspiration related to practices from medicine and quality systems, and took as its core principle the idea that humans will make mistakes no matter the level of education or attendance, and that, accordingly, technological systems should be designed in such a way that it prevents these failures to result in fatalities or severe injuries. Thereby Sweden was one of the first countries to utilize a societal mission based on an explicit ethical concern. With hindsight, the policy can thus be considered a MIP *avant-la-lettre*.

The overarching research question that guided our research has been **how mission-oriented innovation policy can be improved learning from the Swedish Vision Zero program**. To answer this question, we first analyzed the success factors underlying Vision Zero in Sweden. There

were many including an ethical stance towards safety (instead of one based on cost-benefit reasoning), systems thinking, ambition, management by objectives, learning from best practices, in-depth studies based on scientific research, and a broad collaboration. There were however also factors that contributed to the success of the policy but were not part of the policy itself. Factors such as personal attributes of key actors and the role of the car industry. A complete list can be seen in figure 5.

Success factors of Vision zero		
From coding attribute		From interview directly
Success factors (attribute)	↔	1 Systems thinking 2 Ethics 3 Ambition 4 public support
VZ ways of working and getting things done	↔	5 Education of Vision zero 6 Procurement 7 Management by objectives 8 Policy package
Continious improvement	↔	9 Best practices 10 In dept studies
Taking responsibility	↔	11 Responsibility change
Personal attributes	↔	12 Personal attributes
Vehicle industry	↔	13 Vehicle industry
Information sharing	↔	14 Broad collaboration

Figure 5 Success factors of Vision Zero

When confronting the success factors to the failure list in the Weber-Rohracher framework (Weber & Rohracher, 2012), it became clear that the Vision Zero policy indeed addressed many of the failures in this framework, except network failure and policy coordination failure. It also became clear that the framework can be extended with a new concept of failure, which we called ‘momentum failure’. This failure may occur along the way once the success of a policy makes actors involves self-satisfied and less inclined to continue experimenting and learning.

The success of Vision Zero in traffic safety did not remain unnoticed and has been implemented into different contexts. So is the traffic policy used in other countries such as Norway and cities like London and New York City. Besides the traffic policies, Sweden has also transferred the Vision Zero to other sectors in dealing with safety issues like fire and suicide prevention. However It seems difficult to exactly transfer the Vision Zero principles as used in traffic safety by Trafikverket to other geographical or sectoral contexts. In countries that are larger in population and more diverse social beliefs and a polarized politics, it becomes more difficult to legitimize and implement the policy. It hinders the establishment of shared vision among stakeholders and with the wider society. In addition, the high-trust and informal nature of the collaborative relations between Trafikverket and private firms and NGOs are difficult to copy in other contexts. Looking at the other sectors, the difficulty of transfer Vision Zero principles lies

more in the lack of scientific understanding of the phenomenon and the resulting difficulty to evaluate measures. It seems difficult to take over the policy package as a set of measures. Furthermore, it is more difficult to map the causes and trends of incidents with a fatal or severe outcome.

It is further worth noting that while Vision Zero was adopted at the national level of Sweden, it can also serve as a basis for local policy initiatives, such as regions or cities, especially in policy domains where such levels assume the main responsibility. At lower levels governments, it may be easier to establish a shared (ethical) vision as well as the high-trust networks needed for soft governance modes.

The main lessons, then, that Vision Zero can provide regarding Mission-oriented Innovation Policy are the following. First, there are two important prerequisites that need to be present in a MIP: high-level political support and the ability to measure the aspects of the mission that are to be improved. The political support is important to create a shared vision from the highest governance level in a country, while the ability to measure is important as to build on scientific understanding, which in turn further increases the policy's legitimacy.

Second, MIP can make use of an unrealistic goal yet with wide ethical support, which on its own creates attention and makes sure that everyone strives to their best. As end goals would be set that are seemingly reachable, it is not thought that a mission would make great improvement according to Vision Zero. Besides the articulation of an unrealistic mission, a motivation for a long-time commitment is needed. As it is not sure when the vision is reached, or when this event is more than decades away, measures that are taken will be more focused upon long-term improvements. The practicality of the mission could be provided with also ambitious but achievable interim goals. The inclusion of an ethical argument complements such an ambitious goal, as it creates further legitimacy and acceptance, as well as a multi-stakeholder commitment for long time.

Third, MIP should not only consist of an ambitious mission, but also of a strategy. This means that along the use of a mission also a right strategy should be used that is often called the policy package. Therefore, a right policy-mix should be used to make the transition to the desired goal, where the mission is the overarching goal and standpoint wherefrom the rest of the measures should be derived from. The inclusion of an ethical argument is another strong factor in both the acceptance of the mission and the commitment for long time. With an ethical argument nested in the mission several arguments that are based upon cost benefit relations or behavioral freedoms can be opposed to a certain level. This again is helpful in the development of a shared vision in society and politics.

Finally, MIP can be tied to market creation. With actively sharing the vision with a broad range of actors, including industry, a market for safety that was not present before the vision was created. It should be noted however that the policy package is composed of a wide set of measures to reach this goal. Measures such as the systematic approach, creating a productive government industry relation, investing in traffic safety innovations, using public procurement for innovation, and creating well-respected standard setting organizations. Having said this, it must be acknowledged that not all societal challenges can be translated into market demands and will thus have to fall under public policy and/or civic society.

## Bibliography

- Alkemade, F., Hekkert, M. P., & Negro, S. O. (2011). Transition policy and innovation policy: Friends or foes? *Environmental Innovation and Societal Transitions*, 1(1), 125–129. <https://doi.org/10.1016/j.eist.2011.04.009>
- Amalberti, R. (2001). The paradoxes of almost totally safe transportation systems. *Safety Science*, 37(2–3), 109–126. [https://doi.org/10.1016/S0925-7535\(00\)00045-X](https://doi.org/10.1016/S0925-7535(00)00045-X)
- Arrow, K. (1962). {E}conomic {W}elfare and the {A}llocation of {R}esources for {I}nvention. *The Rate and Direction of Inventive Activity: Economic and Social Factors*, 609–626.
- Arthur, W. B. (1983). On Competing Technologies and Historical Small Events: The Dynamics of Choice Under Increasing Returns. *Iiasa*, (September).
- Atkins, D., & Granhed, M. (2012). Vision Zero: Applying road safety to avalanche safety. *International Snow Science Workshop*, 16–22. Retrieved from <http://arc.lib.montana.edu/snow-science/objects/issw-2012-016-022.pdf>
- Belin, M.-Å., Tillgren, P., & Vedung, E. (2011). Theory and Practice in Sweden: A Case Study of Setting Quantified Road Safety Targets. *Journal of Health & Medical Informatics*, 01(01), 1–5. <https://doi.org/10.4172/2157-7420.1000101>
- Belin, M.-åke, & Tillgren, P. (2013). Vision Zero . How a Policy Innovation is Dashed by Interest Conflicts , but May Prevail in the End, 16(3), 83–102.
- Belin, M. Å., Tillgren, P., & Vedung, E. (2012). Vision Zero - a road safety policy innovation. *International Journal of Injury Control and Safety Promotion*, 19(2), 171–179. <https://doi.org/10.1080/17457300.2011.635213>
- Bergek, A., Jacobsson, S., Carlsson, B., Lindmark, S., Rickne, A., Jacobsson, S., ... Rickne, A. (2007). Linköping University Post Print Analyzing the functional dynamics of technological innovation systems: A scheme of analysis Analyzing the functional dynamics of technological innovation systems: A scheme of analysis Analyzing the Functional Dynamics of Te, 3(37), 407–429. <https://doi.org/10.1016/j.respol.2007.12.003>
- Boden, M., Cagnin, C., Carabias, V., Haegeman, K., & Könnölä, T. (2010). *Facing the future: time for the EU to meet global challenges*. <https://doi.org/10.2791/4223>
- Cohen, W. M., & Levinthal, D. A. (1989). Innovation and Learning: The Two Faces of R & D.

- The Economic Journal*, 99(397), 569. <https://doi.org/10.2307/2233763>
- Elvebakk, B., & Steiro, T. (2009). First principles, second hand: Perceptions and interpretations of vision zero in Norway. *Safety Science*, 47(7), 958–966.  
<https://doi.org/10.1016/j.ssci.2008.10.005>
- European Commission. (2018). *Mission-Oriented Research Innovation in the European Union: A problem-solving approach to fuel innovation-led growth*. <https://doi.org/10.2777/36546>
- Fagerberg, J. (2018). Mobilizing innovation for sustainability transitions: A comment on transformative innovation policy. *Research Policy*, 47(9), 1568–1576.  
<https://doi.org/10.1016/j.respol.2018.08.012>
- Fahlquist, J. N. (2006). Responsibility ascriptions and Vision Zero. *Accident Analysis and Prevention*, 38(6), 1113–1118. <https://doi.org/10.1016/j.aap.2006.04.020>
- Foray, D., Mowery, D. C., & Nelson, R. R. (2012). Public R&D and social challenges: What lessons from mission R&D programs? *Research Policy*, 41(10), 1697–1702.  
<https://doi.org/10.1016/j.respol.2012.07.011>
- Fortsatt arbete för en säker vägtrafik. (2007), 1–150.
- Frenken, K. (2017). A Complexity-Theoretic Perspective on Innovation Policy. *Complexity, Governance & Networks*, 0(1), 35–47. <https://doi.org/http://dx.doi.org/10.20377/cgn-41>
- Hammersley, M. (2009). *Open Research Online. Methodological Innovations Online* (Vol. 4).  
[https://doi.org/10.1016/S0346-251X\(01\)00024-0](https://doi.org/10.1016/S0346-251X(01)00024-0)
- Hassan, E. S. (2005). Recall Bias can be a Threat to Retrospective and. *The Internet Journal of Epidemiology*, 3(2), 1–7. <https://doi.org/10.5580/2732>
- Hekkert, M. P., Suurs, R. A. A., Negro, S. O., Kuhlmann, S., & Smits, R. E. H. M. (2007). Functions of innovation systems: A new approach for analysing technological change. *Technological Forecasting and Social Change*, 74(4), 413–432.  
<https://doi.org/10.1016/j.techfore.2006.03.002>
- Johansson, R. (2009). Vision Zero - Implementing a policy for traffic safety. *Safety Science*, 47(6), 826–831. <https://doi.org/10.1016/j.ssci.2008.10.023>
- Kaplinsky, R. (2014). Innovation Knowledge Development, (April), 1–5.
- Kemp, R. (2011). Ten themes for eco-innovation policies in Europe. *S.a.P.I.E.N.S*, 4(2), 1–20.

- Kristianssen, A. C., Andersson, R., Belin, M. Å., & Nilsen, P. (2018). Swedish Vision Zero policies for safety – A comparative policy content analysis. *Safety Science*, 103(December 2017), 260–269. <https://doi.org/10.1016/j.ssci.2017.11.005>
- Lazonick, W., & Mazzucato, M. (2013). The risk-reward nexus in the innovation-inequality relationship: Who takes the risks? Who gets the rewards? *Industrial and Corporate Change*, 22(4), 1093–1128. <https://doi.org/10.1093/icc/dtt019>
- Lindberg, H., & Håkansson, M. (2017). Vision Zero 20 years, 1–48. Retrieved from [http://www.afconsult.com/contentassets/8f0c19f4f7d24aa5bdbfd338128391ec/2017057-17\\_0194-rapport-nollvision-eng\\_lr.pdf](http://www.afconsult.com/contentassets/8f0c19f4f7d24aa5bdbfd338128391ec/2017057-17_0194-rapport-nollvision-eng_lr.pdf)
- Luoma, J., & Sivak, M. (2014). Why is road safety in the U.S. not on par with Sweden, the U.K., and the Netherlands? Lessons to be learned. *European Transport Research Review*, 6(3), 295–302. <https://doi.org/10.1007/s12544-014-0131-7>
- Mazzucato, M. (2013). Financing innovation: Creative destruction vs. destructive creation. *Industrial and Corporate Change*, 22(4), 851–867. <https://doi.org/10.1093/icc/dtt025>
- Mazzucato, M. (2016). From market fixing to market-creating: a new framework for innovation policy. *Industry and Innovation*, 23(2), 140–156. <https://doi.org/10.1080/13662716.2016.1146124>
- Mazzucato, M. (2018). Mission-oriented innovation policies: challenges and opportunities. *Industrial and Corporate Change*, 27(5), 803–815. <https://doi.org/10.1093/icc/dty034>
- Meadows, D., Randers, J., & Randers, J. (2012). The Limits to Growth. The 30-year Update. <https://doi.org/10.4324/9781849775861>
- Mendoza, A. E., Wybourn, C. A., Mendoza, M. A., Cruz, M. J., Juillard, C. J., & Dicker, R. A. (2017). The Worldwide Approach to Vision Zero: Implementing Road Safety Strategies to Eliminate Traffic-Related Fatalities. *Current Trauma Reports*, 3(2), 104–110. <https://doi.org/10.1007/s40719-017-0085-z>
- Metz, B., Meyer, L., & Bosch, P. (2007). *Climate change 2007 mitigation of climate change. Climate Change 2007 Mitigation of Climate Change* (Vol. 9780521880). <https://doi.org/10.1017/CBO978052188013>
- Ministerie van IenW, Ministerie van JenV, IPO, VNG, Vervoerregio Amsterdam, M. R. D. H.



- (2018). Veilig van deur tot deur Veilig van deur tot deur; Het Strategisch Plan Verkeersveiligheid 2030: Een gezamenlijke visie op aanpak verkeersveiligheidsbeleid.
- Mooren, L., Grzebieta, R., & Job, S. (2013). Can Australia be a global leader in road safety?, (August). Retrieved from [ftp://203.30.31.101/rsrpe13/fullpapers\\_20130509/rsrpe13final00115.doc](ftp://203.30.31.101/rsrpe13/fullpapers_20130509/rsrpe13final00115.doc)
- Owen, R., Macnaghten, P., & Stilgoe, J. (2012). Responsible research and innovation: From science in society to science for society, with society. *Science and Public Policy*, 39(6), 751–760. <https://doi.org/10.1093/scipol/scs093>
- Plan, A. (2014). II Vision Zero. Retrieved from <http://www1.nyc.gov/assets/visionzero/downloads/pdf/nyc-vision-zero-action-plan.pdf>
- Reichertz, J. O. (1995). 4.3 Abduction, Deduction and Induction in Qualitative Research Abduction-a Rule-governed Way to New Knowledge? 2. Deduction, Quantitative and Qualitative Induction, Abduction 3. Two Strategies for Producing Abductions 4. Research Results-Reconstruction or, 299–310. Retrieved from <https://pdfs.semanticscholar.org/749f/cb02c73b6a5a54fbda02583d154716baba89.pdf>
- Rittel, H., & Webber, M. (2013). Dilemmas in a General Theory of Planning Author ( s ): Horst W . J . Rittel and Melvin M . Webber Published by : Springer, 4(2), 155–169.
- Rosencrantz, H., Edvardsson, K., & Hansson, S. O. (2007). Vision Zero - Is it irrational? *Transportation Research Part A: Policy and Practice*, 41(6), 559–567. <https://doi.org/10.1016/j.tra.2006.11.002>
- S., G., L.B., C., & S., N. (2011). Are we there yet? Australian road safety targets and road traffic crash fatalities. *BMC Public Health*, 11((Gargett) Centre of National Research on Disability and Rehabilitation Medicine, The University of Queensland, Edith Cavell Building, Royal Brisbane and Women’s Hospital, Herston, Qld, 4029, Australia.), 270. <https://doi.org/10.1186/1471-2458-11-270>
- Schot, J., & Steinmueller, W. E. (2018). Three frames for innovation policy: R&D, systems of innovation and transformative change. *Research Policy*, 47(9), 1554–1567. <https://doi.org/10.1016/j.respol.2018.08.011>
- Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., ... Sörlin, S.

- (2015). Planetary boundaries: Guiding human development on a changing planet. *Science*, 347(6223). <https://doi.org/10.1126/science.1259855>
- The Swedish Transport Administration. (2012). *Analysis of Road Safety Trends 2011*.
- Traffic, S. (2014). Vision Zero Action Plan, 42. Retrieved from <http://www.nyc.gov/html/visionzero/pages/the-plan/the-plan.shtml>
- Vägtrafikskador 2017 253 253. (2018).
- Von Hippel, E., Carter, A., Feld, B., Harhoff, D., Griliches, Z., Katz, R., ... Thomke, S. (1993). "Sticky Information" and the Locus of Problem Solving: Implications for Innovation I am very grateful to my colleagues "Sticky Information" and the Locus of Problem Solving: Implications for Innovation+. Retrieved from <https://dspace.mit.edu/bitstream/handle/1721.1/2493/SWP-3610-28936062.pdf?...>
- Wanzenböck, I., Wesseling, J., Frenken, K., Hekkert, M., & Weber, M. (2019). A framework for mission-oriented innovation policy : Alternative pathways through the problem-solution space. *Working Paper*, 1–29.
- Weber, K. M., & Rohracher, H. (2012). Legitimizing research, technology and innovation policies for transformative change: Combining insights from innovation systems and multi-level perspective in a comprehensive "failures" framework. *Research Policy*, 41(6), 1037–1047. <https://doi.org/10.1016/j.respol.2011.10.015>
- Whitelegg, J., & Haq, G. (2006). Vision Zero : Adopting a Target of Zero for Road Traffic Fatalities and Serious Injuries, (July), 115. Retrieved from [postmaster@sei.se](mailto:postmaster@sei.se) [www.sei.se](http://www.sei.se)
- Zwetsloot, G. I. J. M., Kines, P., Wybo, J. L., Ruotsala, R., Drupsteen, L., & Bezemer, R. A. (2017). Zero Accident Vision based strategies in organisations: Innovative perspectives. *Safety Science*, 91, 260–268. <https://doi.org/10.1016/j.ssci.2016.08.016>

## Appendix A. List of interviewees

List of interviewees	Occupation
Interviewee A	Trafikverket
Interviewee B	Trafikverket
Interviewee C	Trafikverket
Interviewee D	Trafikverket
Interviewee E	Trafikverket
Interviewee F	Trafikverket
Interviewee G	Academic
Interviewee H	Academic
Interviewee I	Industry
Interviewee J	Industry
Interviewee K	Industry
Interviewee L	Other governmental
Interviewee M	Other governmental
Interviewee N	Other governmental

## **Introduction**

What is your current position?

How is your position related to Vision Zero?

Since when you have been working with Vision Zero

## **History of Vision Zero**

What means Vision Zero to you?

How was the idea of Vision Zero started?

- *Which parties were main initiators?*
- *What was the old policy about?*
- *why did it gain large support from the beginning*

Vision Zero is received as a successful policy, what are the main contributors for the success?

The initial target of traffic fatalities (270) that was set for 2007 was not met (490) and the policy was revised why was the target not met?

Which measures were taken to improve the policy?

The last five to ten years traffic fatalities are not decreasing anymore, why is this?

## Policy development

One of the key points of Vision Zero is the new idea of the sharing of responsibilities on the road. Vision Zero departs from the normal way of responsibilities on the road by splitting the responsibility between the system designer and the road users. While in regular road systems all the responsibility should be carried by road users. To get the change in responsibility, what has been done to achieve this change.

- *To what extent does legislation play a part in this?*

The role of the system designer also includes private parties, how did parties get involved into the policy.

- *How are private parties encouraged to make initiatives?*

With the role of the divisions of responsibilities inside the road system, what has been done to improve the behavior of road users since a lesser part of the responsibility is on their part.

Vision Zero is a long-term policy program, how is made sure that short sighted politicians keep supporting the policy?

Where extra financial means opened by Vision Zero policy, and to what extent?

- *To what extent have the infrastructure changes of Vision Zero extra costs?*

To what extent have product innovations related to Vision Zero contributed to the success of the policy?

(procurement for innovation or private parties that innovate)

To what extent have user innovations or innovations made by communities contributed to the success of the policy?

What has been done to coordinate the policy between different government levels (National, provinces, local)

- *Are there measures taken to guarantee the responsibility of lower governments?*
- *If local governments are responsible for roads but lack financial measures to improve them, which measures can then be taken?*

What should be done in the future to get to Zero fatalities

- *Eliminating of fatalities will get more expensive when more are saved, how should this be approached*
- *How fit autonomous vehicles within the future of Vision Zero.*

### **Vision Zero outside Sweden and other sectors**

Vision Zero type policy has been used in other sectors such as fire prevention and for suicide, how does these policies compare to Vision Zero.

- *Which attributes share success*
- *Which attributes of Vision Zero in traffic don't work in the other sectors*

Other countries (SUN) have also a clear history in Traffic safety but are lesser known than Sweden in this context, what would the reasons be?

Is there anything else you'd like to tell me about Vision Zero?