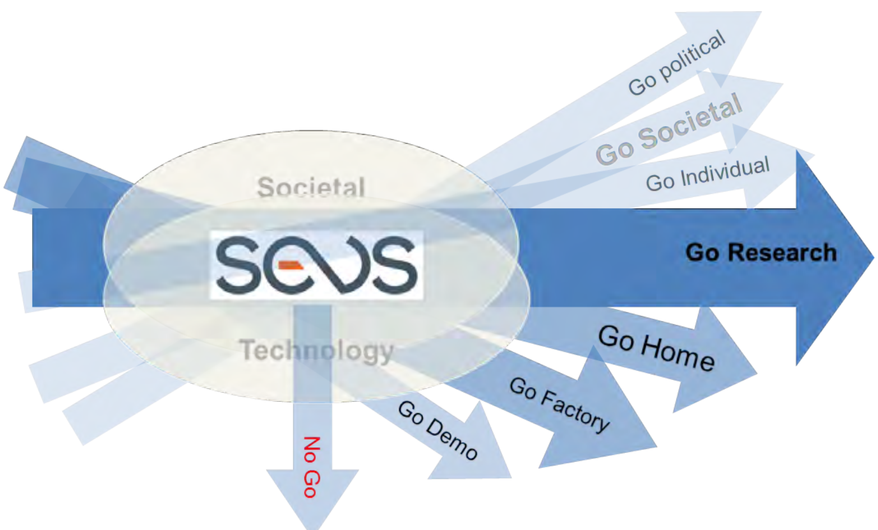
SAFE, EFFICIENT VEHICLE SOLUTIONS



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Project within: A Strategic Project

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Content

FFI in short

FFI is a partnership between the Swedish government and automotive industry for joint funding of research, innovation and development concentrating on Climate & Environment and Safety. FFI has R&D activities worth approx. €100 million per year, of which half is governmental funding. The background to the investment is that development within road transportation and Swedish automotive industry has big impact for growth. FFI will contribute to the following main goals: Reducing the environmental impact of transport, reducing the number killed and injured in traffic and Strengthening international competitiveness. Currently there are five collaboration programs: **Vehicle Development, Transport Efficiency, Vehicle and Traffic Safety, Energy & Environment and Sustainable Production Technology.**

For more information: www.vinnova.se/ffi

FFI

1. Executive summary

The purpose of the SEVS2 project is to strengthen the Swedish automotive industries ability to analyze and address complex societal and technological challenges related to the transition to a sustainable mobility and transport system by 2030+. SEVS2 focuses on challenges in city environments where transportation is one part of the sustainable city solution. To study this has required the analysis of many different actors, mostly outside the automotive industry, since a transition of the road transport system requires the knowledge and active involvement of many different stakeholders. The analysis has focused on Gothenburg, as an example of a small western city, and also compared results to Shanghai, as an example of a growing Asian mega city.

The SEVS2 project has developed an analysis model explaining the key driving forces and how they influence future road transport. The driving force model has been used, together with the method and scenarios developed in SEVS1, to analyze a future city road transport system where electro-mobility is one of the main solutions for personal and goods transport.

The multidisciplinary SEVS-team has analyzed prerequisites and system consequences of electro-mobility and what is required for an effective transformation of today's transport system. A key aspect of the SEVS2 project has been to use already existing knowledge from a wide set of actors and integrate it into a form that is useful for the analysis of future road transport.

The project has not only delivered many results, but also many *types* of results. Some of the main results and deliveries are:

- An effective method for performing analysis of complex societal and technological questions in a multidisciplinary team with many experts with very different background
- A driving force model, which can be used to analyse the mechanisms that directly and indirectly influence the future transport system
- Four scenarios of different possible futures, which describes how the city and the transport system may develop depending on how uncertain, but influential, driving forces play out
- Analysis of which transport solutions are selected under different circumstances, starting from a user perspective but also including indirect factors in the rest of the society. The analysis has identified potential winning solutions, but also identified the most influential factors, enablers and barriers for the success of different transport solutions
- Analysis of electro-mobility as a solution for sustainable city transport shows that the success of electro-mobility is a question of city planning and energy supply challenges, rather than user requirements. Therefore, its main driving forces and blockers will be found in policy and the transport supply business

- A lot of and important insights on the strength and weaknesses of different solutions from a system perspective
- The overall analysis has also lead to many useful insights about the transformation of the society and recommendations for the analysis of certain factors to avoid common errors when dealing with the future.

The project has been led by SAFER and SHC, both national Centres of Excellence, hosted by Chalmers, together with a wide set of partners from vehicle OEMs, academia, institutes and other businesses. The project was carried out during 2012-2013 and had a total budget of about 15 MSEK of which 50 per cent were financed by FFI.

2. Background

There is a strong trend towards a sustainable society in general, with the transport system being much in focus. The transformation of the transport system has often been seen as a matter of developing new vehicles and fuels under fairly well defined boundary conditions. However, the most important driving forces that influence this transition originate outside the transport system itself and are expected to change in the future. This will have a strong influence on the development of road transport and mobility solutions. The speed at which different driving forces and boundary conditions develop is also expected to be very different between different parts of the world. This will strongly influence the development of road transport and mobility solutions.

Researchers from many different disciplines have studied the development of the transport system from their specific perspective, e.g. energy and fuel supply, new vehicle technologies, safety, economy, city planning, customer behaviour and communication technology. Thus, there is a lot of knowledge on how individual driving forces act, but none of these researchers can with great confidence answer what the resulting effect on the transport system will be. The combined effect of all these different driving forces must first be understood. Due to the very different nature of the involved driving forces and the complex relationship between them there is a need for a synthesis work, building a common model including the key driving forces. When involving a large number of experts and stakeholders there is a need for a structured method for how to effectively perform the analysis in multi-disciplinary teams.

The demand for sustainable transportation solutions will reshape not only the vehicles, but also business models, development and production processes, services, technologies, education, management, partnerships and supply chains. Many steps to be taken require coordinated action from several of the involved actors. Due to the very rapid changes taking place there is a need to promptly initiate a dialog between key actors influencing the transport system. SEVS2 has been an important step towards addressing this need.

During 2009-2010 SEVS1 addressed the question of how the future vehicle concepts would need to be designed in order to meet the requirements for safe and energy efficient transport. The project identified the need for a more detailed model of driving forces that had to be created by experts from many other disciplines. SEVS2 is a natural extension of SEVS1 and takes the analysis one step further. It focuses on the driving forces and how they influence future transport, rather than the vehicle solutions. SEVS2 has further explored the scenarios developed in SEVS1 and used them as a tool to understand the requirements, how they differ in different possible futures and how they influence the transport system. SEVS2 has had a special focus on solutions based on electro-mobility.

Several other studies have contributed to a better understanding of the future. These studies provide excellent insights and describe the challenge and the opportunities. However, they look more at possible breakthroughs in technology than at possible trend shifts originating from driving forces outside the transport system that may influence the transport system more profoundly and thus also the relevance of new technologies.

The intention of SEVS2 has been to extend the work of these earlier studies by a thoroughly exploration of a wide set of driving forces and processes and then apply the knowledge to study electro-mobility for road based transport solutions. Shanghai and Gothenburg have been selected to offer two quite different contexts for the analysis.

3. Objective

The purpose of SEVS2 is to strengthen the Swedish automotive industry's ability to address complex societal and technological challenges, related to the transition to a sustainable mobility and transport system.

The direct contribution of the project lies mainly in:

- *Identifying and integrating global and local societal and technological driving forces into an analysis model*
- *Scenario analysis of electro-mobility as the main technological enabler of sustainable mobility and transportation solutions in cities. Descriptions of prerequisites and consequences in different scenarios.*
- *Analysis of transition challenges on a system level. Direction of challenges to other stakeholders as well as initiating relevant research among SEVS partners.*
- *Establish methods for multidisciplinary multi-stakeholders co-operation and analyses of complex systems in a structured way.*

Indirectly SEVS2 will also strengthen the participating persons' and organisation's ability to address complex transition challenges.

4. Project realization

The SEVS2 project was initiated by the so-called “difficult questions” about future societal and technological challenges, formulated by AB Volvo, VCC and Scania. This was the basis for the partner invitation, the manning of different work packages (WP), competences and the prioritized use case selection.

The project was divided into four main work packages; WP1 The Driving force Model, WP2 Scenario Analysis, WP3 Transition Guidelines, WP4 Project Management and Open Innovation Platform. The overall methodology originated from Malmeken AB, but was further developed during the project process. Completely new methodologies were invented and existing methodologies were combined in new ways, e.g. the Sustainability assessment methodology.

The project and its work packages has been characterised by an inclusive process. Over 50 workshops have been conducted, in which typically 15-20 participants worked together in multi-disciplinary teams and learned from each other as part of an open innovation team. If some key competences were missing during the process, the project invited the necessary expertise to join one or several workshops or seminars. The Driving Force Model that was developed as part of the process can from now on actually be used to identify necessary competences.

The team building process has been very successful, resulting in mutual respect among participants from many different organizations and professions. Each individual has shared his or her knowledge and has also been open about their lack of knowledge. The project has been characteristics by a climate of openness, trust, fun and professionalism. The gender balance has been about 50 per cent male and 50 per cent females.

The methodology for analysing complex systems was developed in parallel with the actual analysis and can be useful for other project or studies within or outside the transport industry. To be able to disseminate also this result, the project decided to produce a handbook, The SEVS Way, something that was not included in the application’s list of expected results.

During the whole project there has been problems to man the management of each work package except from WP1. This has caused serious delays in the time schedule.

Figure 1: The Handbook "The SEVS Way"

5. Results and deliverables

5.1 Delivery to FFI-goals

The SEVS2 project was designed to address the overall challenge of creating attractive, profitable and sustainable road transport solutions. In doing that, it covers almost all parts of the FFI program. SEVS2 also addresses many of the targets for all of the specific FFI-programs, with the exception of *Hållbar produktionsteknik*..

All the targets in the *Energy and Environment* program has been more or less included in the analysis within the project: Energy efficiency, reduced CO2 emissions, renewable fuels, reduced toxic emissions and noise. Especially the role of electro-mobility as a mean to reach these goals has been investigated.

SEVS2 has also contributed to reach the targets within the program for *Fordons- och Trafiksäkerhet* through including significantly increased safety as a driving force to be investigated.

SEVS2 has also contributed to reach one of the main targets of the program for *Fordonsutveckling*. The developed Driving Force Model has been used to identify and analyze new vehicle and transport concepts from a system and society perspective.

SEVS2 was also well matched with the program strategy of *Transporteffektivitet*. SEVS takes a holistic approach and covers the whole area described in the program. As a consequence of wide approach of the project, the SEVS2 project did not go into details in all areas of this FFI-program. SEVS2 delivered a very useful overall study that will significantly contribute to the understanding on how the different parts of the program strategy could reach attractive overall solutions.

SEVS2 has covered more or less all the *Övergripande effektmål* for the program and has also analyzed many of the *Effektmål*, like new business opportunities, new business models, increased capacity in existing structures and systems approach.

The individuals that participated in the SEVS2 project have, in more than 50 half- or full-day workshops and five seminars, broaden their perspectives and increased their knowledge and understanding about the complex transport system. SEVS2 has directly and indirectly contributed to the overall goals of the FFI program.

5.2 Summary of the method: The SEVS Way

The long-term development of the transport system cannot be understood unless it is studied as a part of society. Such a society perspective is of growing importance since many of the strongest driving forces influencing the transport system have their origin outside of the transport system itself, like resource scarcity, changing values and new city planning paradigms. What makes the task even more complex is that important effects on the transport system may often be side-effects of other changes in society. If the analysis is narrowed down too much, there is a large risk that we will not see them.

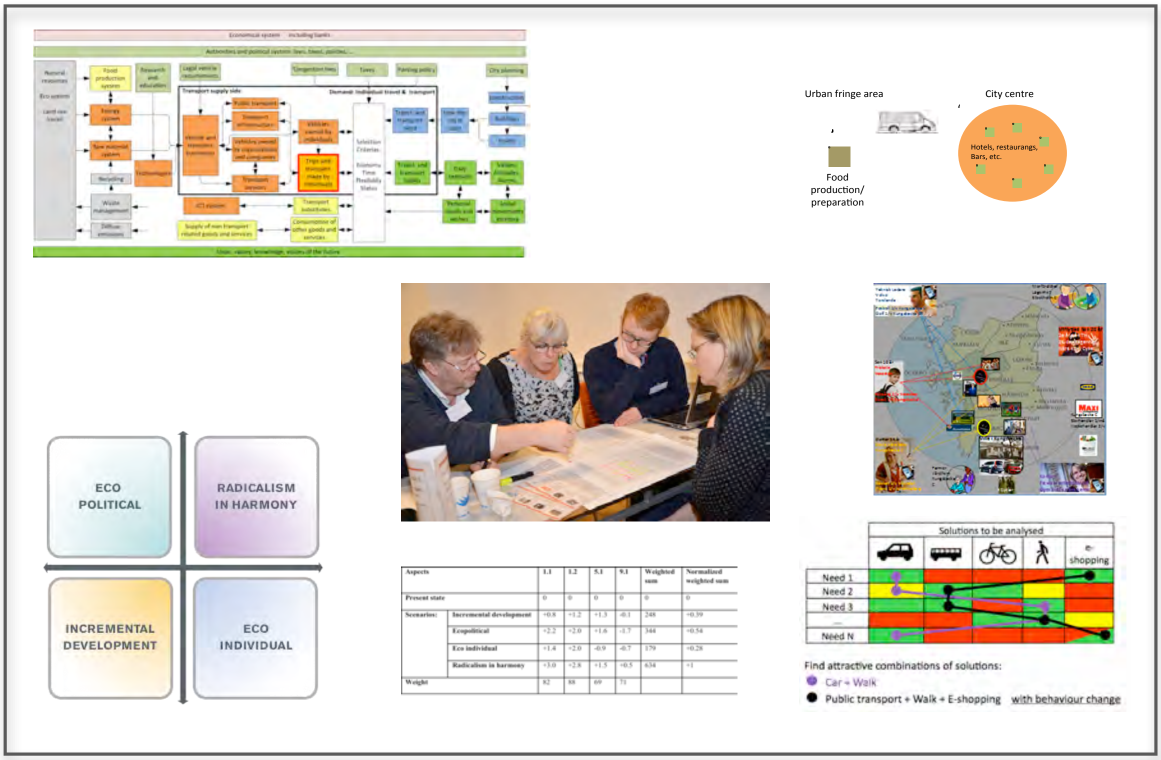
Figure 1: What is a good solution is determined not only by its own properties but to a large extent by indirect factors like competing solutions, life style and policies.

As humans, we are rather bad at handling complex problems, and even worse if we try to do it by just thinking about them on our own. We tend to base the conclusions on a fuzzy mix of data from all types of sources, personal experience and feelings. So, when analysing the future from a society perspective we need methods that help us reduce the influence from personal feelings, that instead help us identify which data and arguments are the most relevant to use in a particular case. The SEVS Way is a method that enables us to handle the questions and highlight the challenges in an effective, rational and structured fashion in well-defined steps.

The method comprises a number of key elements:

- A multidisciplinary team of experts
- A driving force model to handle the complexity of the many driving forces that influences the future society
- Several scenarios providing concrete pictures of different possible outcomes of the future society and that influences the outcome of Transport analysis (below)
- Use-cases, well described for personal transport and transport of goods

- Transport analysis based on the key actor's/user's favoured selections of transport solutions using defined Selection criteria for different use cases and the different scenario's prerequisites
- A Multi Criteria Sustainability Assessment to evaluate the relative sustainability of different solutions.



Figur 2 The key elements of the SEVS method: A multidisciplinary team, driving force model, Scenarios, use-case-based transport analysis and sustainability assessment

At the start of the SEVS2 project, the industry partners formulated so called Difficult questions about future societal and technological challenges. They made the scope more concrete and governed the invitation of partners, the manning of different work packages etc.

A few examples of the quite many initial Difficult questions are:

- Which are the primary drivers and indicators for electro-mobility in urban areas?
- How will regulations governing goods logistics systems develop – e.g. city terminals, night time delivery, zero emission zones?
- Under which conditions will the speed of change i buyer behaviour be higher than we see today (electro-mobility)?
- Which technical crossroads will we face over the coming years

Driving force model – to explore what shapes the future

The driving force model enables us to think in terms of real causes and effects and to bypass personal feelings, preferences and intuitions that tend to be biased by what we want to find. If we can stop our brain from jumping to conclusion by breaking down the argumentation into smaller steps it will become evident which arguments are the relevant ones and which aspects that should be considered in each step of the analysis.

The model is a visual representation of how the driving forces influence the transport system in both direct and indirect ways and how the driving forces interact with each other. Using the model, each driving force can first be discussed one by one and as a second step be integrated in the final analysis to create a holistic understanding. The Driving force model is the map that helps the group to decide the route for the exploration, telling what to focus on and what to ignore in each step of the exploration.

A large number of direct and indirect driving forces have been identified. They were organized into six groups to make the Driving force model easier to understand:

- Political/Legal
- Economical
- Spatial: Land use, City structure
- Social: Values, ideas, behaviour
- Technological
- Environmental and Natural resources

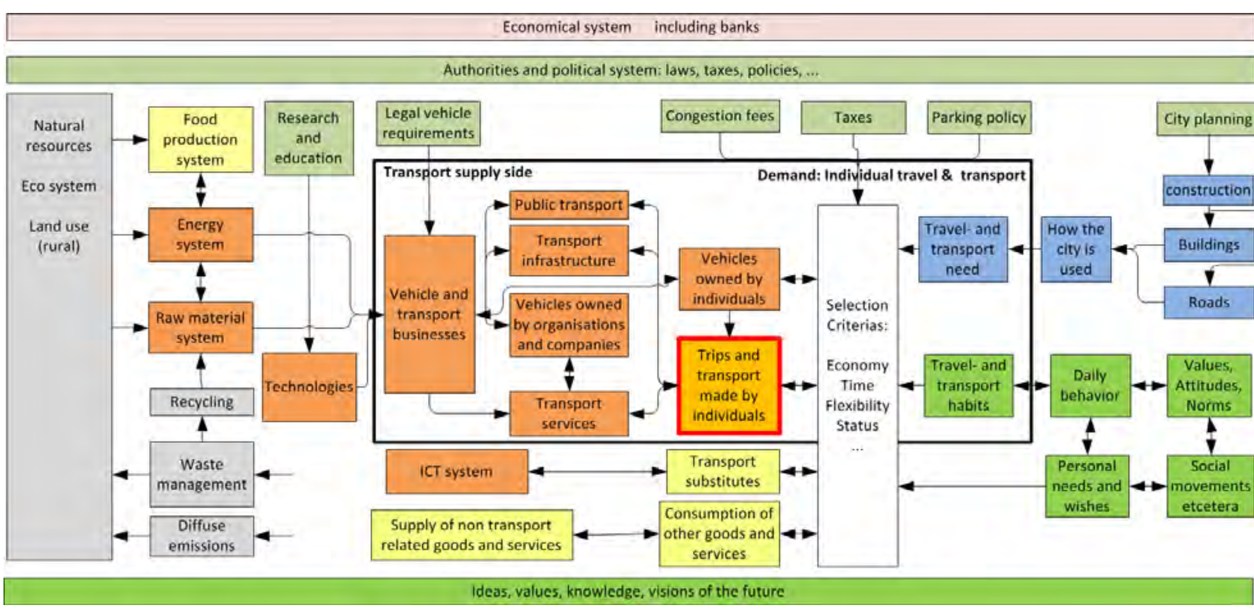


Figure 3 The Drive Force Model describes how factors close to the selection of a transport solution are influences by many indirect, strong and interconnected driving forces, usually from outside the transport sector.

Scenarios - pictures of possible futures

The Driving force model illustrates which driving forces shape the future, but not how they will play out. To analyse the future we need to have an idea of what the "values" of the driving forces will be, and what future this points towards.

The driving forces are ranked after how strongly they influence the future transport system and how certain the development of them is. The analysis will show that the development of some critical factors also is very uncertain. This points towards an uncertain future. An effective way of handling the uncertainties is to define a number of scenarios that makes it possible to explore the consequences of these uncertainties.

Note that the created scenarios are not predictions of what will happen, rather tools for exploring possible outcomes. They are selected to be rather extreme, such that the future is likely to fall within the area that they span.

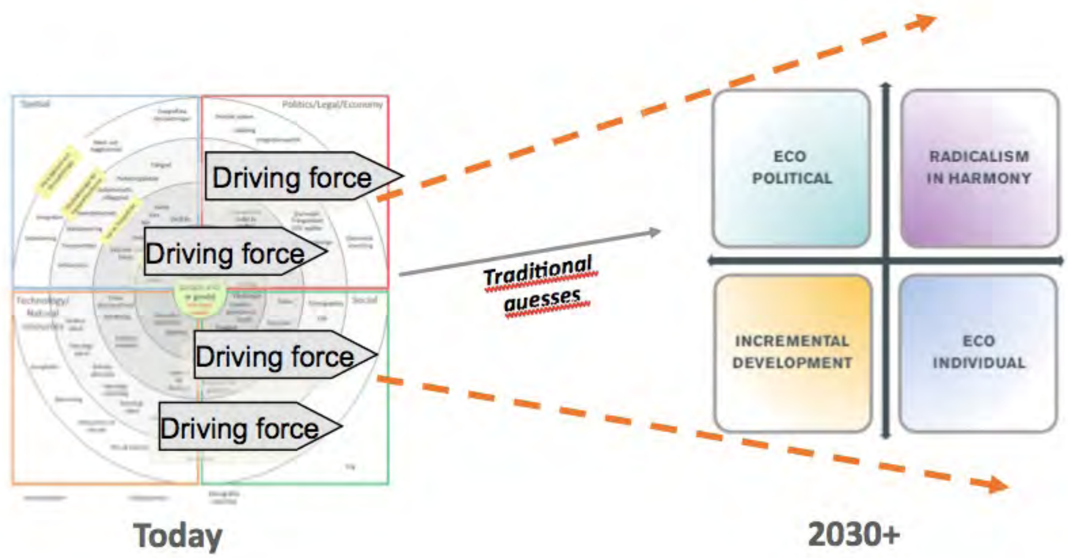


Figure 4 The scenarios are not predictions but describe different possible futures. They are created from analysis of driving forces and uncertainties in how they will change.

The development of many of the driving forces are rather certain and will influence all scenarios in the same way, while other important and uncertain driving forces will cause large differences in the scenarios. The two main dimensions used to generate the SEVS scenarios are:

- *Proactive political system* *vs.* *Reactive political system*
- *Radical change in transport patterns by lifestyle* *vs.* *No change in transport patterns by lifestyle*

The almost generic scenarios are pictures of possible futures, how the society and the physical environment can look like, and how people, companies and organisations behave. They are also described as stories to enable the project participants to "get under the skin" of the actors of the use cases that are tested in these different futures. This minimizes the risk of analysing solutions based on personal experience of today's world. Scenarios also give all participants a common platform for discussions.

Multidisciplinary team - demanding and necessary

The Driving force model and the Scenarios will not answer any question by themselves, they are only effective tools to address questions in a structured way. The actual analysis requires experts from the different areas that are analysed. All projects dealing with complex problems, like SEVS, must be carried out by a multidisciplinary team.

The experts represent different organisations and professions and they typically use different types of models to build knowledge and speak different scientific languages. Working together in a project like SEVS requires the participants to be able to communicate their knowledge in a common language, to be open to use the knowledge of fellow project members and to reflect on how it may influence one's own area of profession.

The key to success is the project management philosophy – e.g. managing open innovation and handling cross-organisational boundaries – as well as the attitude of the participants. The cooperation must be based on an inclusive process where the participants have many chances to discuss and reflect on the results together, giving the knowledge time to spread and be tested by the other participants. It is important to let some participants focus on the integration of the overall knowledge while others can plunge into different analysis.

Transport analysis – finding probable solutions and understanding why

A main task for SEVS has been to analyse transport of people and goods, with a focus on electro-mobility. Each question to be analysed requires an initial study of the Driving force model to identify where and by whom key decisions are made and which mechanisms influence the specific question. This first step will form the starting point of the further analysis. In the SEVS2 Transport analysis, the key actors are the ones that choosing transport, i.e. the person or households doing the travel and the transport company or transport buyer respectively.

Using use-cases

It is vital to describe the transport needs of the actors in questions in order to determine which of the transport solutions that will be selected. For personal transport, an activity based use case model was used. A use-case must cover not only the frequent transport needs, since more unusual needs may influence the mode of transport for everyday travel. A typical example is the family's yearly ski vacation trip that induces a need for a larger car with space for more passengers and luggage.

The use-cases and the actors' needs are translated into functional requirements, capturing factors that influences the choice of transport, e.g. start and end points, time available, number of passengers, luggage, etc.

The Transport analysis of goods transports were also based on use cases, but not activity based since the transport of goods are much more repetitive. Instead, the range of selection criteria was broadened, adding factors such as service level, customer relation, special requirements like cooling of cargo, security and policies.

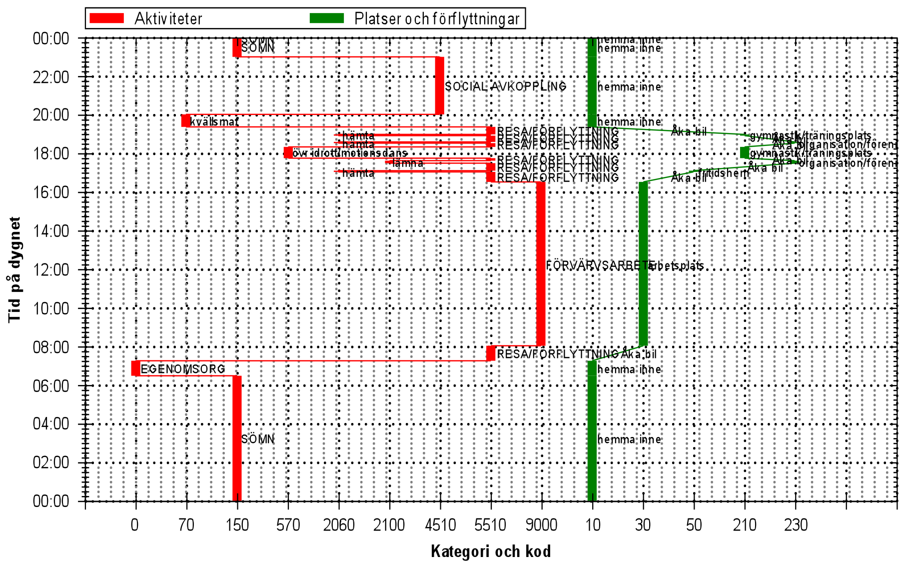


Figure 5 Geographic representation and activity based description of a use-case for personal transport. Diagram produced with DAILY LIFE Version2011 (2.6.0.0) © Kajsa Ellegård & Kersti Nordell in cooperation with Lena-Karin Erlandsson and Gunilla Liedberg

Selection criteria

The key to understanding a decision by an actor is to know the criteria the actor use when comparing the alternatives. The selections criteria used in SEVS2 are based on research on how companies and peoples make their transport decisions. This is however not an exact science, since people often are governed by habits instead than rational arguments.

Prio	Personal transport	Goods transport
1	Time	cost
2	cost	reliability
3	convenience	time
…	---	Frequency, flexibility, …

Table 1 Exemple of selection criteria when choosing means of transport for personal and goods transport.

Transport solutions

The final ingredient of the transport analysis is a list of transport solution candidates. Theoretically, it should include all possible transport solutions that an actor will be able to choose from in the future. For practical reasons, it will be reduced to a manageable number of main alternatives. Note that also substitutes for transport should be included, enabling the analysis to include behavioural changes that alter the transport need.

Analysis

Decisions about transport modes are not made independently. For example, the decision to buy or sell a bike or a car will influence the coming decisions. The right conclusions can only be drawn if one takes a user's combined decisions into account. To do this in a manageable way, each trip is first analysed on its own, assuming that the user has access to a car or a bike. Based on these sub-analysis it will be possible to identify one or more combinations that will fulfil almost 100 per cent of the functional requirements (trips) in the use-case. It is only by looking at these packages of transport solutions that the attractiveness of the transport solutions can be compared. The analysis has to include the transport needs of the whole family (as one entity) to see, for instance, if there is a need for one or two (or no) cars in the family.

It should be possible for the actor to change behaviour in order to avoid or change the need for transport. This can include to moving to another area, changing hobby or planning the daily activities in a different way. Authorities, businesses and football clubs may also change their behaviour to influence the transport needs.

Finally all different combinations of transport solutions, with or without behavioural changes, are analysed based on the characteristics of each scenario. This will give us "winners" of the different scenarios. At least as important as finding the winning solutions is what led to the conclusions, e.g. what factors that had the strongest influence on the result, and which trips of the use-case that are most difficult to meet.

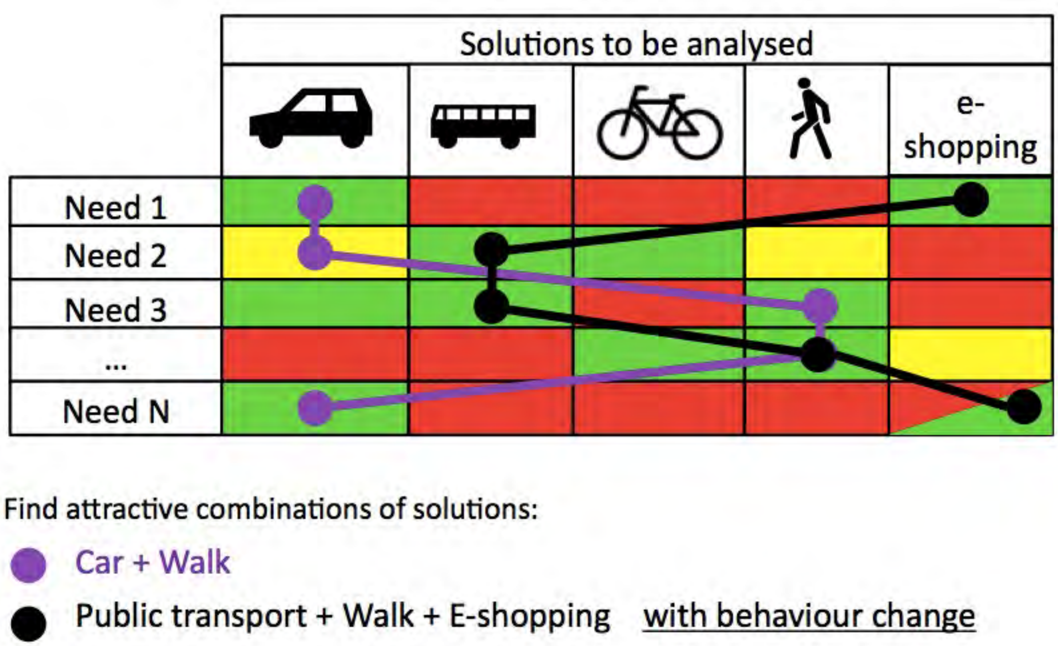


Figure 6 In the first step every need or activity are analysed separately, assuming that the user has access to a car or cycle. In the next step the best combinations are identified, also comprising behavioural changes or decisions that changes the prerequisites.

By studying several different families and their combined decisions, it is possible to value the potential for, let's say, public transportation in an area. Or the other way around: How attractive is it for actors like schools or shops to meet possible behavioural changes by the users or customers? If users want a change in a particular service but the supplier of the service does not find the change attractive, it will not happen.

Sustainable assessment

By comparing the winning solutions in the different scenarios from the transport analysis much can be understood about the sustainability aspects not only for the solutions themselves but also for the society in different futures that would foster this solution.

Firstly, the group needs to formulate the relevant *sustainability criteria* for the study, typically using the three dimensions environmental, social and economic as a starting point. One criterion could for instance be Minimum of killed or seriously injured persons by or during transportation.

The assessment is performed as a qualitative *multi criteria analysis (MCA)*, which is suitable when there are criteria with different dimensions that have to be valued compared to each other and when there are different stakeholders involved. During workshops the participants have to agree upon how well the transportation solutions in each scenario are performing for each sustainability aspect. 0 is equal to the present situation and -3 is the least favorable and +3 the most favorable. If no consensus is reached after discussions, the average from a vote will be used. In the same way, the importance of different aspects is given weights from 0 to 100.

The result will be a table with weighted sums for the different solutions or for the whole scenarios. Understanding what led to the results – sometimes contra intuitive – will lead to insights in both in sustainability and the mechanisms behind it.

The process to formulate sustainability resulted in 18 criteria that was used on the winning solutions from the transport analysis of "the Kungsbacka family" and "Kurt the baker"

The results from the multi criteria assessment show that the transportation solutions in the scenarios are more favorable from a environmental perspective compared to the present state, but also that the social and economic performances in the scenarios vary and are not always favorable compared to the present state.

6. Dissemination and publications

6.1 Knowledge and results dissemination

Today (the 2014-03-31) the new IPCC report was presented. It had a focus on the effects of the ongoing climate change and stated that the negative effects are ongoing both on a national, European and global level. Therefore, there is a need of co-operation over both national and organisational borders to achieve sustainable cities and sustainable transport solutions. The SEVS project is a successful example of aTriple Helix co-operation where academia, industry and the public sector work together to handle complex societal and technological challenges.

SEVS2 Activities:
Tomorrow
Between January and March the 18th , 2014 SAFER/SEVS participated in the Horizon 2020 application: **Transport - MG.5.1-2014. Transforming the use of conventionally fuelled vehicles in urban areas** *"Comparing innovative policies, measures and tools that will, inter alia, halve the use of conventionally fuelled vehicles in cities, while increasing accessibility of urban areas and improve air quality and road safety".*

The application is co-ordinated by Moveo and the name is TOMORROW; Tools and policy guidelines for new eco-friendly Mobility systems for tomorrow. 17 partners from 8 countries are part of the application; France, Italy, Poland, Portugal, United Kingdom, Germany and Sweden (by SAFER and the SEVS project). From Västra Götalandsregionen also the cities of Trollhättan and Kungsbacka are part of the application as "mirror cities". If the application passes Step1, Step 2 will be initiated in June 2014, i.e the second application due for September 2014.

JPI
In the end of November 2013, Bisek suggested to apply to the European project Join Program Innovation. Thanks to the SAFER and SEVS collaboration platform we managed to compile an application on short notice: "New Roads for a Societal Transformation of the Transport Sector in the face of Climate Change". That the application fulfilled the formal requirements was confirmed in December, but in February 2014 we received the message that it did not pass to the second application phase.

Pilot – external workshop
In January 22nd 2014, a workshop was arranged together with the Gothenburg Urban Transport administration. About 45 participants from the administration, the regional cities council (GR), the regional Public transport company (Västtrafik), Gothenburg City Planning Authority, the City Borough Committees, the City Property Management Administration, outer suburbs etc. During the workshop the SEVS team had prepared "an analysis game" based upon "The SEVS Way". The participants were satisfied with both the process and the results.

6.2 Publications

The SEVS project has resulted in a number of sub-reports, PMs and other background material, as well as input to other reports. The content of the Sub-reports are compiled to form the "The SEVS way", a handbook that both serves as a guide for using the SEVS methods and models and a summary of the results of the analysis made by the project.

List of sub-reports

Name and content	ID: SEVS2-PM-xxx	Authors
The SEVS Way – an introduction	WPx-introduction-SEVSWay	Anders Grauers
The SEVS 2 Driving force model	WP1-DrivingforceModel	Anders Grauers
Driving Forces: Users values and behaviour	WP1-Drivingforce-User-behaviour	Åsa Aretun, Cecilia Jakobsson Bergstad, Catherine Pescheux Svensson
Driving Forces: Freight Transport Buyers' Behaviour	WP1-Drivingforce-transport-buyers	Anna Mellin
Enhanced SEVS scenarios 2030+	WP1-Scenarios	Malin Andersson, Jonas Åkerman, Maria Grahn, Hans Arby
Transport analysis: Use Cases Personal Transport Gothenburg and Shanghai	WP2-UseCases-personaltransport	Åsa Aretun
Transport analysis: Analysis of Personal Transport	WP2-Personal-transport-analysis	Anders Grauers, Lars Greger et al
Transport analysis: Urban Freight Transport and Use Case Analysis in the Scenarios	WP2-UrbanFreight-all	Sönke Behrends, Ulf Ceder, Jenny Karlsson, Sofia Löfstrand, Anna Mellin
Safety Scenario assessment	WP2-Safety	Yngve Håland
Multi Criteria Sustainability Assessment	WP3-MCA-sustainalibity	Ulrika Lundqvist
SEVS 2 Conclusions	WP3-conclusions	Anders Grauers
Addressing the GOs and transition guidelines	WP3-Gos	Hans Arby
Managing Open Innovation – Questions, stakeholders and people	WP4-open-innovation-process	Else-Marie Malmek

List of other project documents

Name and content	Authors
The city driving forces	Mikael Ivari
Trends in public transport (SWE)	Jan Gustafsson
Smart cities and IT	Mikael Haglund
Fuels and vehicle technologies and how these may differ in the four scenarios	Maria Grahn
Technology + business: 'How development in technology and business models influence the development of transportation	Sofia Löfstrand
Shanghai Trip report	Else-Marie Malmek et al
China Analysis Report	Else-Marie Malmek et al
Additional uses cases Personal Transport	Anders Grauers
SEVS 2 Transport analysis Game Setup	Anders Grauers, Hans Arby

The SEVS Project also contributed to other reports such as “Electro Mobility in Norway - Experiences and Opportunities with electric vehicles”, TøI report 2013,

Parallel to the SEVS2 the City of Gothenburg Urban Transport Administration developed a new Transport strategy. Participating in the SEVS2 project and adopting the scenarios planning methodology from SEVS1 contributed to a successful process.

7. Conclusions and future research

Conclusions

The goal of the SEVS2 is to analyse future transport systems in general terms rather than only answering specific questions. Therefore, conclusions have been reached on different levels. This section provides an overview with examples of conclusions. The important results are not each individual conclusion presented here, but how they exemplifies the method analysing and understanding future transport systems, both for electro-mobility in particular for sustainable transport in general.

An important disclaimer: The project has not had the goal to reach consensus on the questions analysed. That has been an important aspect of the process, ensuring an open discussion despite the fact that different partners have had different interests. The conclusions presented here are thus not the official standpoint of the project partners, just examples of typical conclusions drawn by the project participants.

The selected conclusions are sorted under different categories.

Driving forces

- A driving force model is a vital tool in handling the very many different factors that influence the transport system in a systematic way and to not get lost in the complexity.
- The driving force model cannot by itself be expected to predict what will happen; for that, the system is far too complex. The model is typically used to explore what changes are most likely to happen or to test what would be required for a certain change to take place.

SEVS scenarios

- Scenarios are a key tool for effectively analyse different solutions in a larger group as they provide a common general scene that can be used to test ideas and discuss and communicate different aspects.
- The business climate will look very differently in the four scenarios. A market driven by private customers that really demand and pay for sustainable transport will open up for many inventive solutions on an individual, and often local, level. However, solutions requiring heavy investment in public infrastructure and changed legislation, like coordinated system across countries and continents will instead require a proactive and strong political system to be a main driving force.

Selection of transport solutions for people/goods

- A plug-in hybrid is a strong candidate in all scenarios (i.e for the investigated Gothenburg family in 2030), since it does not require behavioural changes and only limited infrastructure support in form of a charger at home.
- The cost of fuel represent a small part of the total cost of city distribution, thus fuel efficiency is not a critical factor for the transport supplier compared to for example the time required for distributing the goods. On the other hand, for long haul the cost of fuel has a quite large effect on the total cost. I.e. the solutions selected by the market for these two segments will most likely be very different as the fuel cost increase.

Conditions for electro-mobility

- Electromobility is not primarily driven by customer demand, and therefore cannot be well understood by only focusing on users and their needs. Key driving forces for electromobility will come from policy and changes in the energy markets.
- A plug-in hybrid is a strong candidate in all scenarios for the investigated family, since it does not require behavioural changes.

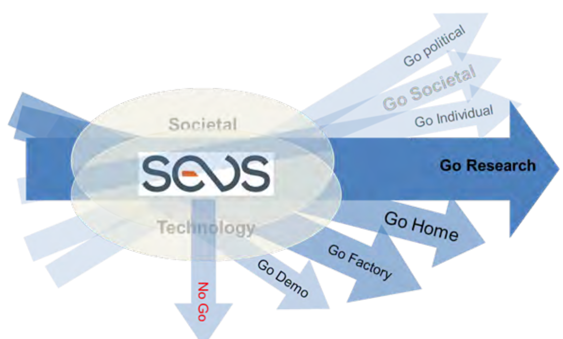
- Electromobility for private cars are still far from cost effective compared to traditional petrol and diesel cars. It is not just a matter of waiting for some reductions from increasing volumes.

Insights on how to understand future transport

- The transport solutions and society has developed in symbiosis; if one is changed the other will be influenced.
- One should be very careful to draw conclusions when analysing a solution with the focus to achieve only one objective. Solutions in the real world always end up being compromises between many conflicting requirements. It is extremely rare that the most realistic solution is an extreme one, where just one of the properties like energy efficiency is maximized.

Further research

The SEVS2 project has resulted in new knowledge, new insights, important conclusions and a set of tools for analyzing complex systems that can be used to tackle other sets of questions. Another goal of SEVS2 is to induce action and progress by addressing different issues to sectors or organizations that are best suited to handle them or make use of them.



These so called GOs comprise challenges, risks and possibilities on one side and stakeholders who need/want to address them on the other. The GOs are based on the results, conclusions and unanswered question from the previous steps of the process. They have been identified during workshops and by separate analysis of the results. The compilation was made as part of Work Package 3, named Transition guidelines.

Examples of topics suitable for research (or demo) projects:

- Not just electro-mobility: Assess possible impact on the society by the introduction of game-changing technology (e. g. autonomous systems) and identify general characteristics of solutions that have a high probability of succeed and the conditions needed. How will the solutions, or their spreading, differ in the scenarios, and how will safety be influenced?

- Traffic safety issues: How will traffic safety be affected in cities with mixed traffic, if small, one-, two- or three-wheelers, become popular, with an aging population – and which solutions for increased safety can we foresee, or new combination of safety, autonomous system and ICT.
- Political laboratory: Studying dynamic effects (including rebound effects, feedback loops, tipping points), of untested policy measures in urban areas as part of political science and urban development. For example: How should a zero emission zone be designed and what could the negative side effects be?
- Demos and Living Labs:There may be a need for large-scale demonstrations of electrical roads for example. In such projects, the SEVS results and tools can be used to broaden the scope beyond pure technical, environmental and economic factors. What is the strongest driving forces influencing decisions of key actors? Which solutions or combinations of solutions are most viable under different pre-requisites? What would it take for the concept demonstrated to take off?
- Target centric analysis or backcasting: What will local actors in, for instance, Gothenburg need to do in order for being fossil independent by 2030+? In this case, and as opposed to SEVS2, a common goal is set. Using back casting supported by the Driving force model, the Transport analysis and the Sustainability assessment necessary activities will be identified and addressed to local and regional actors. What need to be done by politicians, what changes will be needed in city planning, what investments in infrastructure are needed. What types of vehicles, new services and business models are both probable and desired. Will some of this need to be demonstrated?

Please refer to the subreport with a more thorough listing of “ GOs” of the five different types.

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