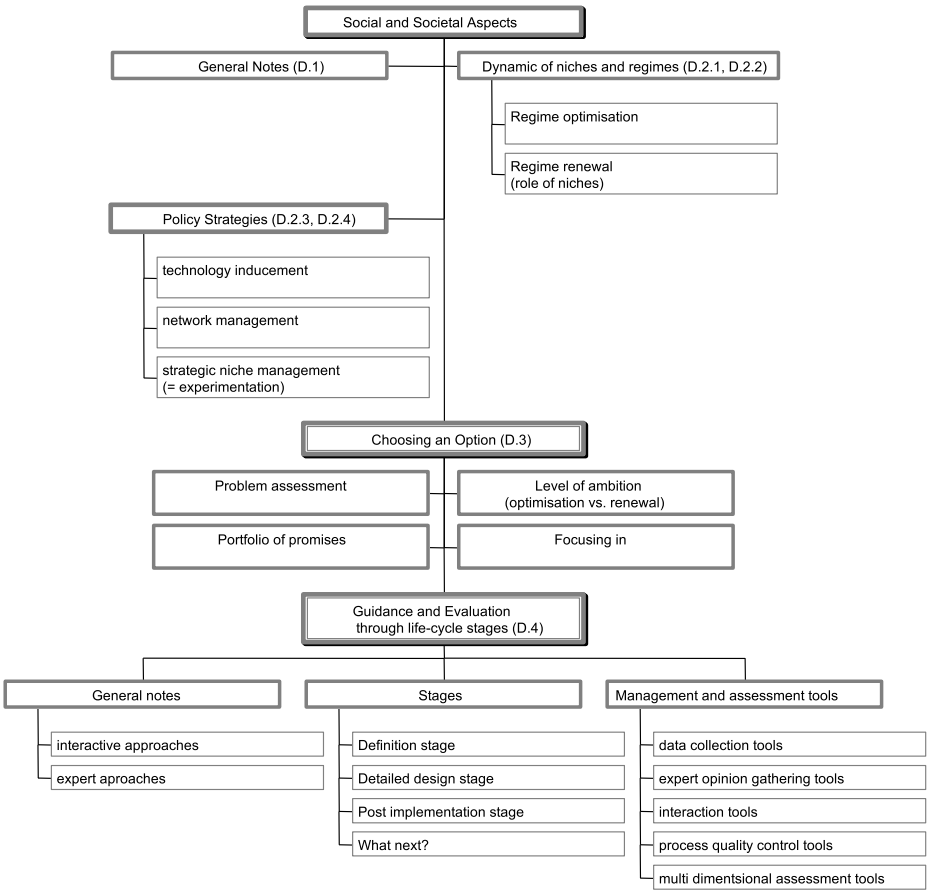
APPENDIX C. EVALUATION OF SOCIAL AND SOCIETAL IMPACTS

C.1 What Are The Social And Societal Impacts In Question?

The social and societal impacts of processes of innovation and, by consequence, of pilot and demonstration projects that are part of such processes, are wide and varied. It is impossible to give a definition of the social and societal impacts that would clearly differentiate it from other aspects such as economic, environmental and traffic aspects. Therefore, a pragmatic approach is chosen in this appendix by highlighting a limited number of social and societal impacts. In addition to introducing the relevant social and societal impacts, we indicate the relevance of these aspects for the set-up, design and evaluation of pilot and demonstration projects.

The diagram below gives an overview of the various impacts that are relevant in the guidance and evaluation of P/D projects or, as we will call them (socio-technical) experiments.[1] The various boxes of the diagram are briefly elaborated in the following text.

Figure C1. Overview of social and societal impacts relevant to transport P/D projects.



[1] Cf. section C.2 and esp. C.2.4 for the reasons we prefer this phrase here.

The aspects included in this Appendix are of a 'general nature' and have a strong impact on the development and characteristics of the traffic and transport regime.[2] Such a choice, by necessity, is somewhat arbitrary, but we presume the main features of the transport system to be covered with the *following social and societal aspects*:

1. *The cultural embeddedness of mobility and transport*

Our transport regime and the way it functions are strongly related to other aspects of the society, or, in one word, to culture. The reason that we travel so much is connected to the spatial distribution of centres of work, living, leisure, etc. as well as the habits we have developed in connection with this.

2. *Traveller behaviour and expectations*

People in our society expect that mobility is both widely available and satisfies certain requirements in connection with ease of use, flexibility, comfort, safety, etc. These expectations have led to a strong preference for the private car as the main mode of transport. These are not just individual preferences that are 'baked into our genes', but have developed as part of a long process of social and technological development and so will continue to change in the future in line with such processes.

3. *Societal problems and needs*

The needs of society are wide and varied. We need a well-functioning traffic and transport regime for society to be able to function. The specific shape of our traffic and transport regime and the way in which it is used also cause major societal problems, including health problems (through emissions), nuisance (noise and congestion), liveability (unsafe neighbourhoods and streets because of traffic), climate change (greenhouse emissions), and others. This raises many dilemmas as solving problems in one domain often creates problems in another.

4. *Policy and policy culture*

Because transport is a domain of great societal relevance with large positive as well as negative impacts it is also a major policy subject. The impacts of traffic and transport manifest themselves differently at different scales (local air pollution, cross-border acid rain, global climate change) and so various levels of policy (local, national, supranational) all try to influence certain aspects of it. For various reasons the effects of these policies are limited and often counteract rather than reinforce one another.

5. *Processes of socio-technical change*

The societal problems of traffic and transport are large. Many new technologies have been demonstrated that could reduce most of these problems drastically. However, the diffusion of many of these technologies in society is very slow, due to the conservative nature of processes of socio-technical change.

C.2 The Role Of Experimentation

The last point in the preceding section is especially relevant to the MAESTRO project as experimentation takes place within the context of such processes of socio-technical change. Therefore, in this section we will briefly discuss the dynamic of such processes and the potential and role of experimentation as part of them.

[2] It is more common to use the notion of a system rather than a regime but for reasons explained in C.2.1 we prefer the latter.

C.2.1 The Dynamic of Regimes and Niches

Few actors question that the traffic and transport regime causes major societal problems and that there is a need for considerable change. Merely by using technologies that have already been demonstrated it would not be difficult to design a traffic and transport regime with extremely low emissions and that would be much more efficient than the present one. There are two major problems, though, to realise this in practice, notably:

1. *Different actors have different expectations* of what is most promising and what would be worthy of further large investments. This creates a general uncertainty, on the basis of which various actors try to minimise the risk of lost investments or prestige by only taking very small steps at the time.
2. *The alternatives have to compete with an existing situation* that is deeply rooted in society in a variety of ways. Alternatives have to compete with existing infrastructures (e.g. for refuelling), existing modes of production, existing consumer preferences, existing legislation tailored to the current situation, etc.

This existing situation is denoted using the notion of a *regime*, in our case the traffic and transport regime. Regimes are not static but inherently dynamic (that's why we prefer this notion over that of a 'system' which has more static connotations) and a lot of innovation takes place. This innovation tends to be conservative, with small changes at a time because radical changes are likely to be problematic as they would challenge various existing interdependencies so making various actors resist the changes.

The latter point reflects a general characteristic of innovation processes, referred to by the concept of 'path dependency'. Innovation then typically leads to what is called *regime optimisation* which means that problems and challenges encountered are dealt with by optimising the regime in specific directions. A possible alternative is called *regime renewal* which refers to much more profound changes. Focusing on the traffic and transport sector, regime renewal has much more promise to solve the problems at hand but is also much more difficult to realise. However, history shows that regime renewal does take place at times via specific processes in which so-called *technological niches* play an important role.

C.2.2 Development of Technological Niches

Regime renewal is difficult to realise because a large set of interrelated barriers impede radical change. These may include:

- technological factors
- government policy
- cultural and psychological factors
- market factors
- production factors
- infrastructure and maintenance
- possible undesirable societal and environmental effects of new technologies.

Despite these barriers, radical change still takes place occasionally because new technologies are initially developed and experimented with in 'protected spaces' when they are not (yet) ready or able to compete with existing technologies. Such protected spaces are called *technological niches* or just *niches*. In these niches, a new technology is protected by various

actors who believe in its long-term prospects and who are willing to invest time, money, and effort into 'making it work', both in the technological and in the social sense.

Niche-protection has two characteristics: first, it applies to variations *outside* the existing regime; second, it is aimed at *temporarily* avoiding the existing selection pressure. We distinguish three major processes in the development of niches, notably coupling and changing of expectations; articulation processes; and network formation. This is briefly elaborated below.

Coupling and changing of expectations

Actors in a specific regime (like traffic and transport) have expectations about the potential of various new technologies and they are inspired by these expectations in their subsequent actions in relation to these technologies. In their actions they try to convince others of their own views and try to make them co-operate towards the same ends. If a certain expectation is widely shared between different actors they will all work in the same direction attempting to realise it. A strong coupling can thus give expectations a self-fulfilling character. We can distinguish three different characteristics of expectations that are important in understanding how they determine further developments. These characteristics are:

- *robustness*: an expectation is more robust when it is shared by a larger variety and number of relevant actors;
- *quality*: an expectation is of high quality when it is supported by interim results from ongoing developments (innovations that have been demonstrated; co-operation between important actors);
- *specificity*: a specific expectation (for example "electric cars will be suited for commercial traffic in cities") will be realised more easily than an ill-defined one (for example "the future belongs to electric vehicles").

Articulation processes

During the process of niche development, societal embedding of the new technology must be considered. Societal embedding implies that the new technology is integrated into the structure and culture of society. This process can be described in terms of a number of articulation processes, also referred to as learning processes. These processes can be seen as an attempt to overcome the various barriers listed above. The following articulation processes can be distinguished:

- *technical aspects and design specifications*: required adjustments, potential for economies of scale, overcoming initial limitations;
- *government policy*: what changes in fiscal policies and other legislation are necessary to stimulate use of the technology?
- *cultural and psychological meaning*: which symbolic meaning can be given to the new technology? For example, can it be labelled and promoted as safe, environmentally benign and/or modern?
- *market*: for whom (which users) is the new technology produced and what are these consumers' needs and requirements?
- *production network*: who should produce and market the new technology and fuel?
- *infrastructure and the maintenance network*: which complementary technologies, capabilities and infrastructure must be developed and by whom? Who takes care of maintenance? Who is responsible for recycling or waste?

- *societal and environmental effects*: what effects does the new technology have on society and the environment?

Network formation

A niche will require the formation of a new network of actors. Networks of producers, users and third parties have to develop around new technologies, together sustaining their development. The chances for a new network increase when:

- certain actors in the network are willing to put in a lot of effort (maybe even in spite of current developments) to complement the network;
- the capacity (for example financial- or R&D capacity, legislative power) of the actors involved to reach their aims is in their own control;
- the activities of the involved actors are better tuned to each other;
- the already existing network is closer to success; the actors in the network will then make a greater effort.

Under the right circumstances technological niches can develop into new regimes or drastically transform existing regimes. An important question is how public policies can stimulate this to happen such that the traffic and transport regime becomes more sustainable.

C.2.3 A New Perspective on Strategy and Policy

New regimes do not appear suddenly by 'overthrowing' existing regimes. They are a result of persistent growth of technological niches to the point that they start challenging the existing regime and from there on gradually gain the upper hand. Policies could exploit this by targeting what is sometimes called 'modulation' of the existing dynamic. This can be achieved by making intelligent use of technological niches that are present in the regime. By strategic and co-ordinated action, the growth of such niches can be stimulated.

Above, we discussed three main processes in niche development, notably the formation and coupling of expectations, articulation processes, and network formation. To stimulate these processes, three policy strategies can be followed: technology inducement, strategic niche management, and network management.[3] These will be briefly discussed below.

Technology inducement

Technology inducement occurs when technology developers feel compelled by external circumstances to develop and market technologies with specific characteristics. Policy-makers can create such an external environment by influencing the expectations of a specific technology. California's Zero Emission Vehicle mandate (including 1996 amendments) is a good example. This mandate has a strong coercive character but it is also possible to give technology inducement a more rewarding character, using it like a 'carrot' rather than a 'stick', e.g. by creating consortia of buyers for new technologies. A third, indirect form of technology inducement is the stimulation of competing technologies (for example by

[3] This classification of instruments is different from the usual classification in terms of coercive measures (commandments and prohibitions), measures in conformity with the market and social measures. This classification says more about the characteristics of the concerned measures than about the way in which technology development is evoked and is therefore less suited as a frame for a technology policy.

stimulating natural gas vehicles which will put pressure on the development of cleaner diesel technology) and the creation of price advantages for new technology (purchase subsidies, tax advantages).

Strategic niche management

New technology still has to prove itself and faces many barriers. Policy-makers can help to overcome these barriers by starting or stimulating so-called socio-technical experiments. These experiments should focus on gaining experience via the seven articulation processes mentioned above. To make these articulation processes lead to a technology that functions in practice, it is necessary to co-ordinate the activities of a wide range of actors. The (policy) approach targeting this co-ordination is called *strategic niche management* (SNM) [(12)].

Learning in experiments should be organised so that the participants get a chance to develop new ideas and try them out. For example, users should be asked not only to fill out questionnaires but also to experiment with their mobility demand. Follow-up should be given more attention than is often the case in current practice, as well as making the findings accessible to others that might be interested in comparable issues. Pilot and demonstration projects, therefore, are a central part of SNM.

Network management

Actors with vested interests in other technologies will generally not be interested in stimulating new, competing technology. Such actors may participate for defensive reasons but will rarely show real initiative. To let the niche grow, specific new actors must be involved and the activities of existing actors and their interactions must be changed. New network relations should be developed in which the new technology can function as desired. Network management must help such a network to come into being and create the right relations. Care should be taken, for example, that technology development is not dominated solely by the industry, but that users and third parties also contribute.

C.2.4 Challenges for Experimentation

The societal aspects of traffic and transport are strongly related to what is considered problematic in the current traffic and transport regime. What makes the problem more complicated is that different actors have different views on what constitutes the problem. Even if all actors were to share the same view, solving certain problems would be very difficult because they would require drastic reform of the current traffic and transport regime. Such a reform is highly problematic because the existing regime is deeply entrenched in our culture, our economy, our way of thinking, etc. This means that in experimentation we need to face a variety of challenges that should be reflected in the experiment: in the set-up, the objectives, the guidelines, the evaluation methods, etc.

Looking at a variety of experiments in the traffic and transport domain it appears that many of these often have a limited scope. Improving the design of experiments can increase the yield in terms of lessons learned about the potential and feasibility of the technology, the world in which it has to function and the measures that need to be taken to mutually adjust the technology and the social environment in which it has to be produced and used. Optimisation of experiments should aim to make more effective contributions to the development, introduction, diffusion and

use of new traffic and transport technologies, and at the same time support a move to a sustainable transport regime.

For actors who are motivated to develop a technology further (be it for commercial, social or other reasons), an experiment is an opportunity to learn about the possibilities of the technology and thus test their expectations about the potential and feasibility of the technology. They want to make their expectations more specific (learn under what circumstances the technology can be successful) and of better quality (base the expectations on research and actual testing). Thus, there is a cycle of learning:

- expectations lead to the identification of elements that one wants to learn about during the experiment;
- the learning may then lead to modified expectations; etc.

As in most cases no single actor can develop and diffuse a technology on its own (especially in the case of transport technologies). Actors need to build a network with others. Getting other actors interested implies raising their expectations, thus making expectations more robust. Thus, experiments are platforms where all these activities (coupling of expectations, learning about the technology and the expectations, and building and managing networks) can be combined. Experiments are thus crucial elements of a niche development strategy.

In (socio-technical) experiments the emphasis is on learning how new technologies and their societal embedding can be tuned towards another. These learning processes have to be rather open. This contrasts in many cases with pilots and demonstrations that typically are defined more strictly. The distinction is a matter of degree. In the case of a P/D where a specific technology is taken as a starting point and the question is how to fit it into the existing regime, (i.e. regime optimisation) the leaving process is strictly defined. To target regime renewal, more open learning processes are needed where the phrase experimentation is more apt. Because we seek to address both strategies here we prefer the more general phrase experimentation.

C.3 CHOOSING AN OPTION

C.3.1 Problem Assessment

An old Chinese saying states that defining a problem in the right way is solving it. The specific definition of a problem already partially predetermines in which direction solutions are sought. This implies that there is also a risk that a problem definition that is not sufficiently thought through might trigger developments in a direction that does not really lead to solutions. Although defining the problem may seem trivial, it is typically anything but that, especially in view of longer term solutions.

> *For instance, congestion on a main road into a city may be alleviated by constructing a new road. This new capacity, in its turn, may attract new business and, hence, new traffic. Several years later, the new road is also congested as a result of which the problem has only been aggravated.*

Defining a problem, therefore, not only implies looking at what the problem is now but also to try and understand what developments are likely to be triggered by the chosen solution. The problems in connection with traffic and transport are manifold and choosing too narrow a

problem definition might alleviate the problems in one domain but might aggravate problems in another.

C.3.2 Level of Ambition

In general terms, it can be stated that the extent to which objectives can be specified depends upon the level of ambition of the experiment. In view of the discussion in section D.2 it is useful to distinguish between two general levels of ambition in connection with new traffic and transport options, notably *optimisation* of the existing traffic and transport regime and *renewal* thereof. Regime optimisation means that problems and challenges encountered in the current situation are dealt with by optimising the existing regime in specific directions while most characteristics of the regime are left untouched, e.g. by seeking to replace diesel city-buses by natural gas buses to reduce NO_x and particulate emissions. The alternative, regime renewal, implies much more profound changes.

Characteristics of a sustainable traffic and transport regime

To be able to assess sustainability a vision has to be developed of what should be the main characteristics of a sustainable traffic and transport regime. These main characteristics should be derived from an assessment of which characteristics of the current system are the main sources of problems for society. A sustainable transportation system should tackle these challenges all at once or at least ensure that lessening one problem does not increase another. In general terms, the requirements for such a system could be indicated as follows:

- *Customised mobility*: The current forms of private passenger traffic and public transportation should develop into new forms of mobility characterised by a wide variety of transport options which allow a better tuning with a specific transportation need.
- *Mobility as a service*: Transportation should largely be provided through new forms of services by "mobility providers" who are able to offer the full range of options for a specific transportation need, using various types of transport modes when needed.
- *Diversity of options*: A variety of technological options should become available to help align the travellers' needs with the societal needs (reduction of total emissions, fuel consumption and congestion).
- *Drastic reduction of societal problems*: The emissions of substances detrimental to humans and the environment have to be drastically reduced.

C.3.3 A Portfolio of Promises

One possible strategy to realise this could start by developing a limited list of new traffic and transport technologies that, *in combination*, look very promising to satisfy the requirements for a sustainable traffic and transport regime. The basic criterion for a technology to be listed is not short-term market readiness. Although that might be helpful, the essential issue is whether it promises a considerable step forward on one specific sustainability criterion whilst, when used in combination with other technologies, it helps to satisfy other criteria as well. This list, called the *portfolio of promises*, should be developed in conjunction with the variety of stakeholders in the traffic and transport domain.

An example may illustrate how such a wider assessment may lead to different priorities when compared to a narrow assessment focusing on a single aspect:

It can be argued, for instance, that the life-cycle emissions of electric vehicles are considerably lower than for conventional vehicles and that their development should be stimulated. Carmakers argue that EVs will not sell, however, because of limited range and that better batteries should be developed for which they request EU support. The EU may decide to give this support as it is expected to benefit the environment in the long run. This approach, however, tackles only one of the problems of the traffic and transport regime. In that respect, an individual public transport system with small, lightweight electric vehicles (like the Praxitèle system that is experimented with near Paris) offers wider potential because it tries to remove the need to use a private vehicle by offering a better possibility of combining modes. These small electric vehicles only need a limited range and, because they are small, light and efficient, use relatively little energy. Existing batteries are well suited to them. In this case a wider perspective on sustainability leads to the conclusion that to make EVs contribute to a sustainable transport system the battery is not the main bottleneck. Instead it may be more effective to invest scarce research funds in the logistic and other problems to make a system like Praxitèle work.

In current practice, the strategy to solve a specific traffic and transport problem is to identify one specific alternative and to explore whether and how it can be made to work in practice. Taking one step back, however, a first attempt to identify a 'portfolio of promises' has several advantages when these are explored in different locations. These advantages include:

- improved chances that one or more options will be realisable in practice, which implies that societal problems can be solved sooner;
- working on alternatives raises expectations of their potential and puts pressure on the existing regime to enhance the performance of conventional technologies;
- governments will be better able to take certain measures when more options are available. The most desirable of these options can be implemented directly or by making the alternatives less attractive to sell, buy or use. Governments will be better able to use a strategy of technology inducement, for instance.

C.3.4 Focusing in

A process that initially narrows down the variety of options available for a specific experiment seems to be the most appropriate first step in making an optimal choice of measure.

As a first, more general step, several 'mapping' activities are necessary to evaluate the social and societal aspects. To be able to make proper choices, you should map the following:

- the dynamic of the current traffic and transport regime is needed to be able to asses the effects of new developments that are likely to emerge when implementing the chosen alternative;
- views on sustainability and 'portfolio of promises'; what, in the view of different stakeholders, are promising directions for solution; the more overlap there is on the relevance of specific options the larger the chances are it can be realised in practice.
- lessons from experimentation; try to make an inventory of what has been learned elsewhere on the various options that are part of the portfolio of promises;

- effectiveness and possibilities of policy approaches; you may try to get support from other policy levels to stimulate developments on the path(s) you would like to pursue. Instruments at your own disposal might be useful to create synergies with experimentation.

Within the portfolio of promises, eventually you have to focus on a specific technology for a specific experiment. Such a choice can be informed through an assessment of the potential of the various technologies, especially on the following dimensions:

- *problem solving potential*: this may include a drastic reduction of emissions, far better fuel efficiency or use of renewable energy sources;
- *innovation-cascade potential*: the possibility that, once a technology has been demonstrated, it opens up a variety of new options that are likely to challenge new actors to develop it further in other directions;
- *network potential*: refers to the chances to develop a strong network to carry a technological niche, which will be prepared to invest persistently (in terms of money, time, effort) in its further development;
- *regime renewal potential*: an important issue here is whether the technology in question merely replaces an existing technology or whether its use implies a considerable change of attitude of several actors which could become the germ for regime renewal;
- *budgetary considerations*: the budget largely determines the level of ambition you can realise in your experiment.

C.4 GUIDANCE AND EVALUATION THROUGH THE LIFE-CYCLE OF A P/D PROJECT

C.4.1 General Notes on Evaluation: Expert Approaches versus Interactive Approaches

If the level of ambition is rather modest, typically involving regime optimisation, objectives may be rather specific and set unilaterally by the actor responsible for the experiment. This is especially so if this actor is also primarily responsible for scaling up to full implementation if the experiment gives acceptable results. Because the situation is taken to be rather clear it is possible to rely quite heavily upon the knowledge of experts who are familiar with the situation at hand. Their expertise can be helpful in setting the objectives of the experiment as well as in carrying out the evaluation at various stages.

If the level of ambition is high, which is typically the case if regime renewal is the target, setting objectives unilaterally seems much less fruitful. An approach that relies heavily on experts seems much less feasible here and it is needed to emphasise *interactiveness* in the process instead. Regime renewal implies that various actors will have to change their travel and transport behaviour significantly and then it immediately becomes evident that different actors have quite different interests and priorities. Actors may agree that a high level of congestion in the city is problematic to all of them, but opinions soon start to differ when various options to tackle the problem are suggested. To set objectives fruitfully in such a case an attempt should be made to get sufficient commitment from the most crucial actors in the case at hand implying that the definition of objectives should be subject of interaction between them. In this process most actors may come to acknowledge that it seems impossible to realise in detail what they desire themselves but they each may gain something if they compromise with the others. Because the situation is so diffuse and multifaceted (some of) these objectives will not be very specific. This means that a rather open learning process must

take place implying that evaluation will not be a very straightforward process. Like the objectives, the (preliminary) results of evaluation will have to be the subject of interaction between the actors to ensure that these findings can become the basis for scaling up the implementation if the outcome was desirable.

Setting rather general objectives and carrying out evaluation in a more interactive setting implies that the process of learning also takes a quite different shape. Because the objectives are not so clear cut and different actors have different opinions about the more precise objectives the process implies that the objectives themselves may drift in the process. This may seem problematic as 'textbook knowledge' states that objectives for experiments should be clear to be able to gather meaningful results. However, if it is ensured that the reflection upon objectives during the experiment is carried out interactively among all relevant actors this may strengthen the learning process. It is only in such a process that commitment from the relevant actors can be gained which is essential to create the right conditions for upscaling after the experiment if this would be considered desirable.

The type of learning is qualitatively different from learning in the situation where objectives are rather specific and fixed. When specific objectives are used, we call 'first order learning', whereas if the learning also takes place in relation to the definition of the objectives themselves, implying that various actions become reflexive, we call this 'second order learning'. Second order learning seems essential if the overall target is to renew (parts of) the traffic and transport regime. So many things will have to change that it is not possible to assess up-front which directions are most promising. To be critical of one's own assumptions and preferences is essential to find out what may have practical value, especially since it is required to create a minimal degree of consensus between actors in a situation that a large degree of dissensus is the starting point.

C.4.2 Guidance through life-cycle Stages

C.4.2.1 Project Definition Stage

Here, the broad parameters of a P/D project should be defined. This should not only entail setting objectives but also ensure that the right process is used to arrive at them. Objectives, therefore, are both in term of process and of content. The 'process manager' starts a process primarily on the basis of a problem he/she encounters and defines, but has to be open to the views of other relevant actors so that the project group can eventually arrive at a workable solution. These evaluation objectives are basically aimed to assess whether the pursued option offers a sustainable solution to the problem at hand and whether the experiment provides a sufficiently promising step in the right direction and to ensure that resources are in accordance with ambitions. The objectives in this stage are:

- defining (sharpening) the problem; assessing (appraising) various potential solutions
  - assess business as usual scenario
  - some problems in terms of content
  - some in terms of process
  - barriers
- create awareness among partners on dynamic of current regime
- assess portfolio of promises; what type of solutions look promising in principle
- barrier assessment (cf. Section D3); what are the barriers or unknown factors to realise the various promises in practice and, hence, what should the learning goals of possible

experiments be to lower (some of) these barriers and gain better knowledge of the unknown factors?

- appraise four types of potential different options (problem solving potential, innovation-cascade potential, network potential, regime renewal potential; see Section D.3); assess their relevance
- map lessons from elsewhere
  - evaluation of knowledge available and gathered elsewhere (possibly abroad); analyse reports and interview actors involved elsewhere and make visits
  - discuss these findings with stakeholders to get their views on what's considered relevant
- identify relevant stakeholders (not only participants!); give examples
- map actor requirements and expectations in current situation
  - map 'promising room to manoeuvre'; i.e. what user attitudes might change under different circumstances; what would be needed to change these circumstances
  - what new transport concepts/technologies could fit such new requirements
  - be clear on whether the target is 'renewal' or 'optimisation'
  - map views on sustainability and portfolio of promises
- choose, define contours of 'most promising' route for solution, taking into account the local situation; choose promising niche as 'framework of the experiment'; specify the option to explore, barriers to overcome and sketch the process to lower and possibly remove the barriers
- identify which articulation processes need to be gone through (cf. Section D2.2); specify 'general' learning targets
- are the ambitions or learning goals in accordance with resources like possibilities for funding and organisation?
- given the ambitions and learning goals, is it helpful and possible to team up with partners in comparable situations to get a better matching between scope and resources?
- develop a plan for experimentation with consecutive steps, learning targets for each step, role of various partners/stakeholders in each step, method to assess and evaluate the findings of each step, procedures for interaction between partners and discuss the details of the next step.
- assess feasibility of the plan in various terms like available technology, available budget, commitment of relevant actors, etc.

C.4.2.2 Detailed Design Stage

The following aspects should play an important role in the detailed socio-technical design of an experiment and, hence, in its pre-implementation evaluation:

- define detailed learning goals in connection with the various relevant articulation processes; do they sufficiently reflect the barriers identified?
- do the learning targets reflect the 'overall target' ('renewal' vs. 'optimisation')?
- does the experiment promise to make a significant step towards realising the characteristics of a sustainable traffic and transport regime (cf. Section D3.2)? Is there a risk that progress on one dimension may result in a step back on another?
- asses appropriateness of the partner network surrounding the experiment; does the constitution of stakeholders involved reflect the learning goals of the experiment?

- have the various stakeholders been involved in defining the design of the experiment; are they committed to the design and the learning goals? Are they convinced of the necessity of and open to learning?
- assess expectations of various stakeholders to be able to monitor learning while carrying out the experiment
- do the more technical elements of the design reflect the technical aspects of the learning goals?
- are monitoring, measurement and evaluation schemes in accordance with the learning goals?

C.4.2.3 Post Implementation Stage

The objectives at this stage are to:

- check if expectations have been met in terms of robustness, quality and specificity (see D.1.3)
- identify circumstances needed to make the niche grow; assess requirements
- make lessons learned available to others
- check if the stakeholder requirements have been changed or specified
- find out whether that opens up possibilities for new options.

C.4.2.4 What next?

After the conclusion of the experiment, the findings should be evaluated in view of the problem that initially triggered it and assess to what extent these findings are useful to help develop a solution. The findings are used as a basis to decide what to do next. This may render various types of assessments, like:

- The results clearly indicate how the option can work in practice; the issue is now to scale-up and implement it in practice.
- We have learned certain aspects giving us a better indication that 'the promise' can be realised in practice but further experimentation is needed before it makes sense to scale-up and implement it.
- The results are basically negative, indicating that the promise cannot be realised along the lines that were investigated. Let's forget it and work on something else.

Whatever the findings of the experiment, it is never a 'failure' if care is taken that the lessons learned are used to define the steps that follow. In the final case listed above, experience on what does not work, and more importantly why it does not work, can give clues for alternative approaches that hold a better promise. Unlike current practice, it should be recommended that such 'negative' results are widely published and made available. It may help other stakeholders in comparable situations to use their resources more effectively, either by preventing them to embark on the same route or to give a different twist to it that holds more promise.

If it is concluded that further experimentation is needed to explore the measure further the whole process as described above can be started again with a different content. If it is concluded that the issue should be scaling-up a new set of issues becomes important which depends upon a variety of characteristics of the option that has been tested. Such issues may include:

- 'pure' market issues: is there an interested producer that is willing and able to invest?
- are infrastructures needed that require public decision making and resources?
- is new regulation needed?

These issues lie beyond the experiment proper but they should also be addressed in the process of the experiment to avoid a possible waste of resources. It would be an enormous waste if an expensive experiment with a new transportation mode were carried out while it would appear afterwards that the necessary funds for the necessary infrastructure could not be raised. Of course, there will always be surprises and no guarantees will be given but it is advisable to make an assessment of the whole process that is needed to realise a new transport option to be able to decide that the experiment is indeed a step in the right direction and that there are no other 'insurmountable' barriers that should be dealt with first.

The basic issue here is that experimentation is part of a longer process of development and practical use of new technologies and that as much as possible of that whole process should by 'mimicked' in the experiment. For instance, if it is clear that public authorities will have to invest heavily later on in connection with infrastructure, the actors that take the initiative should make sure that these authorities are also part of the experiment. This will give them a certain commitment which will make them more prepared, if they evaluate the results positively, to provide additional support later on.

C.4.3 Socio-Technical Management and Assessment Tools

The goals that have been discussed in this Appendix are very heterogeneous and a variety of different methods are needed to realise them and to gather the necessary information for this. In the following, a list of useful tools is briefly introduced.

A. Data Collection Tools

- work-visits to places with comparable problems and/or that have experimented with or implemented specific solutions
- stakeholder interviews and/or stakeholder surveys
- Data collection via the internet

B. Expert Opinion Gathering Tools

- expert advice
  - on 'content'
  - on 'process management'
- delphi method
- expert advice on designing experiments too optimise learning
- 'enlightened' expert opinions on promises of alternatives and requirements to 'make them work'

C. Interaction Tools

Strategic Niche Management

- Definition
- Experiments and Strategic niches
- Coupling of expectations
- Learning processes
- Network formation

General

- interactive meeting with heterogeneous stakeholders:
- 'consensus conferences'
- heterogeneous learning

D. Process Quality Control Tools

- network management

E. Multi Dimensional Assessment Tools

- Multi criteria analysis
- scenario analysis (socio-technical scenarios)