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Transition management as a model for sustainable mobility

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Abstract

In this article we present a model for transforming a car-based mobility system into a more sustainable one. It is based on visions of sustainable mobility, the use of strategic experiments and special programmes for system innovation, to complement transport policies such as road pricing, emission standards and so on. The article does three things: it describes the model of transition management as a model for transformation and where it comes from, it offers recommendations for mobility policy derived from transition thinking, and it discusses the uptake of transition thinking in policy and practice. The conclusion is that transition management helps various actors to be more engaged with long-term change, but that a process of re-institutionalisation is needed to make serious progress to systems of mobility which combine user benefits with societal benefits.

Keywords: Sustainable mobility; Transition management.

1. Introduction

Road transport produces a number of problems which have proven difficult to deal with: emissions, congestion, noise, unsafety, landscape fragmentation and dependency on oil. To deal with these problems transport experts have proposed several solutions: support of cleaner cars, road pricing and other forms of mobility management, higher fuel prices and other measures to internalize external costs, promotion of public transport and non-motorised forms of transport, traffic and transport information, promotion of teleworking and the use of urban planning and spatial planning limiting the need for transport (Newman and Kenworthy, 1999; Banister et al., 2000; Rietveld

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and Stough, 2004; Banister, 2005; Docherty and Shaw, 2007; Holden 2007; Banister, 2008).

With regards to safety and non-CO2 emissions some successes have been achieved through regulations. Attempts to promote public transport and reduce car traffic however have more or less failed. It has proved impossible in car-based societies to create transport systems that are attractive for users and attractive for society as a whole in the sense of reduced negative impacts. Given that most of the problems are related to automobility, the question arises whether the existing transport system can be transformed into something more sustainable.

In this article we present a model for transforming a car-based mobility system into a more sustainable one. It is based on visions of sustainable mobility, the use of strategic experiments and special programmes for system innovation, to complement transport policies such as road pricing, emission standards and so on. The model for transformation is transition management. According to those involved in its creation, transition management is a new mode of governance that aims to resolve persistent problems in societal systems, including a policy model to influence long term societal change (Rotmans et al., 2001; Rotmans, 2005, 2003; Loorbach 2007; Loorbach & Rotmans, 2006; Kemp and Loorbach, 2005). The basic premise is that sustainable development requires transitions: non-linear processes of social change in which a societal system is structurally transformed (Rotmans, 2003).

In this article we set out to do three things: i) we offer a discussion why something like transition management is needed for sustainable mobility, ii), we present research findings based on a multilevel transition perspective, and iii) we offer a discussion of experiences with transition management in the Netherlands in the area of transport: what it is doing and also what it is not doing.

The article is structured as follows. In Section 2 we offer a discussion of why it has proved so difficult to change car-based forms of mobility and why a different approach may be needed, one that is more forward-looking, informed by visions, and adaptive, evolving with experiences and which deals with issues of lock-in. In section 3 we present the model of transition management and recommendations about mobility policy based on transition thinking. In Section 4 we look at how transition thinking is being taken up by various actors in the Netherlands. We describe the rise of transition concepts in the Dutch policy arena, how these concepts were integrated in various research and development programs, and how these applications are being monitored, evaluated and studied. We study this in three contexts: national energy policy, national mobility policy, and an innovation programme for sustainable mobility in the Netherlands. In the last section, we give a summary of our findings.

2. The need for a transition approach dealing with lock-in

In the EU passenger cars account of three quarter of total passenger transport; this share is believed to stay constant according to the Directorate-General for Energy and Transport of the EU in their memo "Keep Europe Moving" of June 2006.

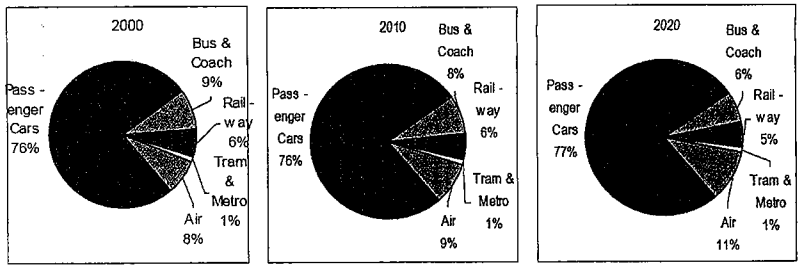

Figure 1: Expected evolution of modal split in passenger transport 2000 -2020[1].
Source: http://ec.europa.eu/transport/transport_policy_review/doc/2006_transport_policy_review_memo_en.pdf.

Car use is facilitated by many factors: car ownership, the decline of public transport, the possibility to combine different tasks such as going to work, dropping off children at school, picking them up and filling the trunk of the car with groceries, to name just three factors. Car use co-evolved with life style changes and was facilitated by government policies and motor car associations. Car use came with all kind of problems including problems for car users. Car users became aware of those problems but in general, people have been disinclined to give up the use of cars because they pollute, contribute to global warming and degrade urban life. They are even disinclined to give up their car when the *use* of cars creates problems for themselves, such as time losses from congestion and high costs. As Sheller (2004: 236) writes: "*Cars will not easily be given up just (!) because they are dangerous to health and life, environmentally destructive, based on unsustainable energy consumption, and damaging to public life and civic space. Too many people find them too comfortable, enjoyable, exciting, even enthralling. They are deeply embedded in ways of life, networks of friends and sociality, and moral commitments to family and care for others*".[2]

Many policies have been formulated and implemented to restrict and reduce the side-effects of cars. Road traffic deaths per million passenger miles have fallen in many countries but the level of casualties is still high (in 2005 in the EU 43358 people were killed in road accidents, down from 50396 in 2001).[3] The compulsory use of the catalytic converter helped to reduce hydrocarbon emissions and nitrogen oxide emissions but the use of the catalytic converter increased fuel use and CO2 emissions. The Euro 5 standards for cars will further restrict emissions, from both petrol and diesel cars, of carbon monoxide (CO), hydrocarbons (HC), oxides of nitrogen (NOx) and particulate matters (PM), which are considered harmful to human health. The tighter standards apply as of September 2009 for new models of cars and as of January 2011 for all new cars.[4]

[1] An overview of differences in transport modes can be found in Eurostat's Panorama of transport 2009. An explanation of those differences goes beyond the scope of this paper. Such differences are caused by transport policy in any simple way. Transport policy is co-evolving with mobility needs and patterns.
[2] The dominance of the internal combustion engine is an important cause for the carbon lock-in (Unruh, 2000). Cheap fossil fuels are a factor in the dominance of the ICE, there is a symbiotic relationship. Lock-in can only be understood systemically.
[3] http://www.etsc.eu/documents/copy_of_copy_of_copy_of_Road%20deaths%202001-2005.pdf.
[4] http://www.euractiv.com/en/transport/euro-5-emissions-standards-cars/article-133325.

In almost all rich countries the share of public transport (railways, busses, metro) has fallen, and, as shown in Figure 1, DG energy and transport of the European Commission expects it to fall to even lower levels in the next ten years in Europe, despite large amounts of public support.

Having failed at achieving a modal split, governments have pushed alternative engine cars. One of the strongest push for this has been in California where the California Air Resource Board created a market for zero emission vehicles through commercialization regulations. The promotion of zero emission vehicles was part of the regulatory programme Low Emission Vehicles which started in 1990. The Mandate requires that by 1998 at least 2% of the vehicles offered for sale in California should be Zero Emission Vehicles (ZEVs), increasing to 5% in 2001 and 10% in 2003.[5]

In this particular case the regulator (being a quasi-independent board) wanted to jumpstart a market for electric vehicles for air quality reasons and industrial policy reasons. Officially CARB took a technology-neutral approach to achieving emissions control (Hoogma, 2000, p. 253) but in reality the board engaged in technology issues and was willing to push for certain technology solutions as the following statement shows:

> *We purposefully push technology as part of our regulatory programme* and that's what we do with clean cars, clean fuels. We've approached it from a systems standpoint because we kept getting the argument by the auto makers, we're not going to do this until we get the fuel, and the fuel folks are saying we're not going to do this unless there's the cars (interview, Air Resources Board, 30 march 1993 by Grant, emphasis added by the authors).

The mandate was a unique phenomenon, occurring in a region subject to severe problems of air pollution. The regulators were led into believing that electric vehicles were close to commercial use, mistakenly as it turned out. In effect, the Mandate created a window of opportunity for *battery electric vehicles* but did not lead to a sizable market for such vehicles. In the 1996-2001 period, the Mandate has been revised three times (in March 1996 when the 1998-2002 requirements were dropped, in 1998 when ZEV credits could be earned through partial electric vehicles and in 2001). Industry efforts shifted towards *hybrid* electric vehicles and *fuel cell* vehicles, which appear to be the beneficiaries of the window of opportunity created by the Mandate. The mandate was an enlightened attempt at forced commercialisation, which more or less failed.

Today battery electric cars are back on the policy agenda. In the last 1.5 year, several governments have expressed a willingness to support the introduction of electric cars (Israel, Denmark, the UK, The Netherlands). In a sense, innovation support and emissions control always has proven easier than to reduce motor car traffic. At the local level, however, several cities did engage in active transport policy aimed at discouraging car use in problem areas (mostly city centres) in the form of one way streets, parking restrictions and tariffs, traffic calming measures, bus lanes, special infrastructure for bicycles and the use of road pricing. Some of the measures, such as the congestion charge scheme introduced in the centres of London, received a great deal of attention. Light rail systems have been introduced in cities such as Bordeaux and Grenoble, quite successfully it seems. On the whole, policies efforts have resulted in

[5] The 1998 requirements correspond with 30,000-40,000 vehicles. CARB expected that by 2010 70% of all vehicles in southern California would be electric (Hoogma, 2000, p. 258).

only small reductions in car-based mobility, which continued to grow in Europe (Eurostat, 2009).

Rather than discussing particular initiatives to make transport more sustainable we want to offer an explanation why it is to so difficult to change car-based mobility systems (first goal). And we want to present ideas for changing car-based mobility systems based on transition thinking, which holds that governments should be concerned with creating a different regime for mobility, based on visions of sustainable mobility.

The reason that car-based mobility is so dominant is not because cars help you to get quicker from place A to B, or that it is the cheapest form of transport; quite often both things are not true. For short distances walking and bicycles are cheap alternatives and for long-distances high-speed trains and airplanes (i.e., collective modes of travel) are often quicker alternatives. Most car users own a car but cars can be rented on a per ride basis, people may share rides, cars could be used by others, and they may be used for certain trips only.

Why then does this not happen? It is impossible to give an exhaustive explanation for this, but the reasons have to do with the need for multiple changes: in infrastructure, economic incentives, better public transport (light rail and fast trains), public transport services (for example, dial-a-ride services), public bikes being available for use, and the decision to no longer own a car but to rent it, something which would encourage a more selective use of cars. Other alternatives are underdeveloped and less well represented in the political process. Intermodal mobility depends on the intermodality of transport systems such as the presence of P+R, the existence of traveling and traffic information systems that inform people about how they may reach their destination with the help of different modes of transport but intermodality is weakly developed and not forcefully supported. There is no association for it. Car drivers don't ask for it and as a public transport user you would have no idea who to turn to for this. Even when people in their everyday life use different modes of transport (often in combination), presently there is no regime for intermodal travel, there are no organisations one can turn to, no one assumes responsibility for services towards this end, transport systems are not organised towards this end. Equally, there are no powerful actors behind slow modes of transport. Bicycling associations have no political clout. Car users are not asking for this; even those who are unhappy about the many negative effects see it as a necessary evil. We are locked into the use of cars.

3. Transition research about mobility

The issue of creating alternative regimes that are more desirable from a welfare point of view is something that is central to work by "transition researchers". In the last eight years a literature developed in which the term transition is defined and in which possibilities for managing transition are examined. The first study to do so was the ICIS-MERIT study "Transitions and transition management" in the Netherlands (Rotmans et al., 2000).

The work of Frank Geels and his Eindhoven colleagues Johan Schot, Rob Raven and Geert Verbong on socio-*technological transitions* is one trajectory of scholarship (Geels, 2002, 2004, 2005; Geels and Kemp, 2006; Geels and Raven, 2006, 2007; Geels

and Schot 2007, 2008), to be distinguished from the scholarship on societal transitions, developed by Jan Rotmans and Derk Loorbach first at ICIS, later at DRIFT, and the work by SPRU researchers Adrian Smith, Andy Stirling and Frans Berkhout (Berkhout et al., 2004; Smith et al., 2005; Smith and Stirling, 2010).[6]

What unites the various transition approaches is that transitions are viewed as the outcomes of developments at the micro, meso and macro level. The micro level is the level of practices, situated in a context of product regimes, regulatory regimes, science and research regimes (conceptualised as meso structures), and the overall macro landscape of values, infrastructures etcetera as the broader context (Geels, 2002, 2005; Rotmans, 2005; Grin et al., 2010). A graphical presentation of the three levels is given in Figure 2.

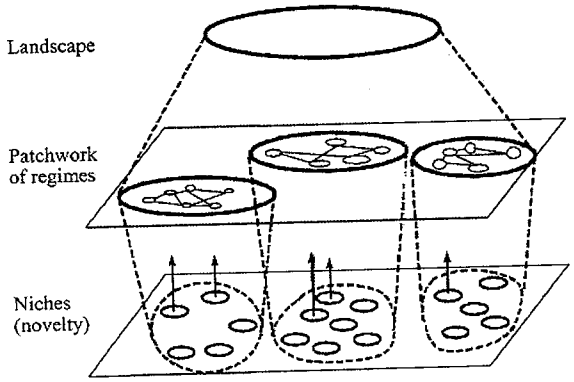

Figure 2: Multiple levels as a nested hierarchy.
Source: Geels (2002, p. 1261).

According to the scheme, novelties emerge in niches, particular domains of use, actor constellations and geography. The novelty may be a new practice, a new technology or special government intervention. These niches are part of a broader world. What happens in the niche is shaped by external developments. For example, the use of bicycles or electric cars is shaped by the road infrastructure, priority rules, fiscal measures, climate change societal concerns and the economics of using other means of transport. These developments not only shape the willingness of individuals to engage in the use of a bicycle or electric car but also shape the expectations and strategies of companies and government.

Novelties must compete with well-developed alternatives. In the transition perspective this competition is conceptualised as a niche-regime interaction process. In transport there is a regime of automobility and a separate regime of public transport. There are also taxis and there is intermodal travel and bicycle use but these are not regimes in themselves in the sense that there are powerful actors behind them and that they have an element of autonomy. The regime notion is a difficult notion for empirical

[6] Important contributions in the form of commentaries have been made by Shove (2004), Meadowcroft (2007), Shove and Walker (2007, 2008)

research. Truffer et al (2008, p. 1361) define a regime as a "a mutually aligned, established set of technological artefacts, use patterns, institutional contexts, regulations, infrastructures etc. that prevail for delivering a specific service, e.g. personal mobility".

A useful attempt to determine whether something is a regime or not, is offered by Holz et al (2008). They distinguish 5 characteristics of a regime: 1) there is a clear goal in the sense of functionality for users and society that is being fulfilled (such as the function of mobility), 2) many things are being combined and aligned with each other, 3) stability (actors do not suddenly orient themselves to something completely different), 4) there is no central actor in charge or everything, and 5) several regime dimensions have relative autonomy (technology, users/markets, policy, science, culture) (Holz et al., 2008).[7]

The third level of the multilevel perspective is the sociotechnical landscape. The landscape is the wider context of practices and regimes. It is being composed of infrastructure and other physical aspects (houses, cities, ...), systems of governance, political associations, regulations, societal values, beliefs, societal concerns, the issues selected for attention, the media, and prices and incomes, social security and so on (c.f., Geels, 2002, 2005) – as general background variables for transport and the car mobility regime.

A visual representation of multilevel interaction is given in figure 3.

The multilevel perspective is an attempt to take account of processes of mutual shaping and the cumulative nature of change, leading to dominant practices, types of knowledge and organisations. Transitions are viewed as the outcome of pressures on product regimes (cultural criticisms, regulations) and the development of alternative systems, elements of which are originating in niches, but breaking out of these thanks to learning economies, support from various actors (including incumbent companies, politicians, civil society) and various processes of alignment. The focus is stability and change. To explain stability the notion of regime is used, which says that we are locked in car-based modes of transport because societies have adapted themselves to their use in terms of car ownership, infrastructure, training and knowledge, regulations, practices and cultural acceptance.[8]

[7] The term regime is preferred over the more widely applied concept of a system. The reason for preferring the regime concept is that the system concept has a much more technical connotation and is rather functionalistic, thus overlooking the ways in which automobility is reproduced socially (by interests, ways of thinking and social practices) as well as technologically: "To speak of a system is to convey the impression of something autopoietic, a set of interlocking features which reinforce each other, and where elements in the system emerge for functional reasons, to correct 'imbalances' or to 'improve performance' of the system as a whole. (...) While this may work as a metaphorical description, as an explanation it leaves crucial features out of the picture. The notion of system tends to underplay collective human agency in the production of automobility and to avoid the political questions about the shaping of the automobile 'system'. (...) We therefore propose to speak not of a system, but of a regime of automobility. Speaking of a regime allows us not only to emphasize the systemic aspects of automobility but also to bring out the relations of power that make this system possible. At the same time, it attempts to avoid the sense of closure in the notion of system, where its internal relations, feedback mechanisms, create a closed loop reproducing its logic relentlessly" (Böhm et al., 2006, pp. 5-6).

[8] The regime concept also helps to explain why public transport did not developed into mobility organizations offering a variety of mobility services, and why they did little to improve the quality of services in terms of experiences: they were locked into a functional way of thinking of running busses, trains and trams rather than offering mobility services. High speed trains are a positive development by

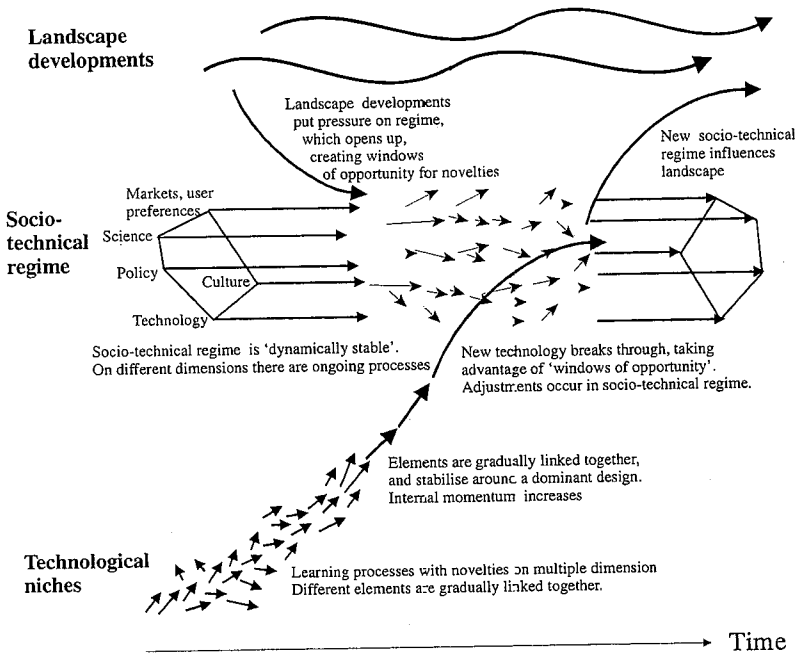

Figure 3: A dynamic multi-level perspective on system innovations.
Source: Geels (2002, p. 1263).

The systemic perspective of transition studies requires a certain holistic view that acknowledges the interaction between human and non-human aspects. The influence on societal systems is not only economical, ecological and technological, but also social, cultural, institutional and political. Cultural change interacts with technical change through social processes in a sociotechnical and economic landscape, in which policy is not an exogenous force but part and parcel of the change process it seeks to manage. As societal systems are complex (e.g. interactions at the micro-level have unintended effects at the macro-level) and open (i.e. adaptive to the systems' surroundings), these systems have certain dynamics of their own which no actor or group of actors can control.

The transition perspective has been applied retrospectively in a case-study on the transition from sailing ships to steam ships (Geels, 2002, 2004) and two studies about car mobility: the development of the Dutch highway system (Geels, 2007) and the societal embedding of cars in Dutch society (Geels and Schot, 2008). Therein the

containing various attractive features for users: sensations of high speed, comfort, possibilities for relaxation, electric sockets for laptops and other electronic devices, restaurant services and quiet coaches in which GSM use is forbidden.

authors note the role of a car association and the role of buses and mopeds facilitating car use by allowing people to gain experience with motorized transport, thus 'wetting the appetite' for cars as an interesting explanation. A prospective application of the transition perspective is Elzen et al. (2004) where the authors come up with two scenarios for future passenger transport, one based on green cars, and one based on customised mobility.

An early attempt to apply transition management ideas to the field of mobility policy was made by transition researchers Kemp and Rotmans (Kemp & Rotmans, in: Elzen et al.: 2004). The authors criticised Dutch policies on sustainable mobility for being too oriented on technological fixes, for being too fragmented and opportunistic, with experiments being carried out more or less ad hoc, without a coherent future vision and without sustainability considerations (Kemp and Rotmans, 2004, p.154). Transition management was proposed as a new mode of governance to orient policy and societal interactions in the field of mobility more towards transitional change. The authors made a plea to orient policy more towards long-term "solutions" (development paths) that are attractive from a user and societal sustainability point of view. The following list of guiding visions was proposed as areas worthy of sustained policy support:

1. *Customised mobility*: the selective use of cars in combination with other modes of transport; individualised public transport, mobility centres and organised car sharing would be part of this trajectory.
2. *Mobility management*: the management of traffic streams through highway entry control, road pricing, cars automatically following each other at short distance using sensors and safety control, information services, electronic zone access management systems using transponders (devices that transmits a predetermined message in response to a predefined received signal) to control access to city centres, parking policy, possibly the use of tradable mobility credits where people get mobility rights which they can either use or sell.
3. *Cleaner cars*: low-emission internal combustion cars, electric vehicles (hybrid vehicles of full electric vehicles powered by batteries or fuel cells,) urban cars, long-distance energy efficient cars with gas turbines.
4. *Underground transport*: this may take various forms including the radical option of vacuum pipes for transporting capsules
5. *Teleworking*: working from home or a local 'telecentre', using modern computer communication, and teleconferencing, reducing the need for commuting but, as a rebound effect, possibly leading to increased travel outside work.
6. *Spatial planning limiting the need for transport*: compact cities, the (re)location of office buildings close to (public) transport nodes.

The authors not only looked at technology but also at policy and governance. In terms of policy and governance, the authors argued for the use of:

- long-term goals and sustainability visions;
- social experiments with promising technologies and creation of niches for promising technologies;
- flexible programmes for system innovation;
- the institutionalisation of a long-term innovation agenda based on ideas from innovative outsiders (Kemp & Rotmans, 2004; pp. 158-161).

The publications of Elzen et al and Kemp and Rotmans were first attempts at applying transition thinking to the issue of sustainable mobility. In the KSI programme 2004-2010 further work was done on transition management as a model of reflexive governance for sustainable development (Kemp and Loorbach, 2006, Loorbach, 2007, Rotmans and Loorbach, 2009). This model came to be known as the "DRIFT" model of transition management for the reason that Rotmans, Loorbach and Kemp worked or have worked at DRIFT.

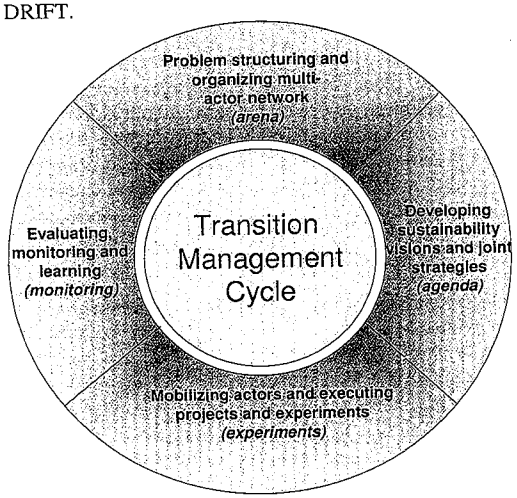

Figure 4: The Transition Management cycle.
Source: Loorbach (2007).

The model of transition management is a model of multilevel governance (Loorbach, 2007), which tries to "modulate" evolutionary processes of variation, selection and retention (Kemp et al., 2007). As explained in Loorbach (2007), the model of transition management makes use of "bottom-up" developments and "top-down" long-term goals both at the national and local level. Visions of sustainability are being explored, in an adaptive manner, using experiments and programmes for system innovation. The basic philosophy is *goal-oriented modulation*: the utilisation of ongoing developments for societal goals. Transition management does not consist of a step plan but uses certain broad heuristics, which are depicted in the Figure 4.

Visions of sustainability are explored in transition arenas, involving actors from government, business and civil society interested in transitional change. The government has a role as process manager, dealing with issues of collective orientation and adaptation of policy. It also has a responsibility for the undertaking of strategic experiments and programmes for system innovation. The basic idea behind transition management is to start a process of change, which is oriented towards the creation of new regimes. Policy choices are made "along the way" on the basis of learning experiences at different levels.

Behind transition management are the following elements, as identified by Meadowcroft (2007):

- *making the future more clearly manifest in current decisions*, by adopting longer time frames, exploring alternative trajectories, and opening avenues for system innovation (as well as system improvement).
- *transforming established practices in critical societal* subsystems within which unsustainable practices are deeply embedded.
- *developing interactive processes* where networks of actors implicated in a particular production/consumption nexus can come together, develop shared problem definitions, appreciate differing perspectives, and above all develop practical activities.
- *linking technological and social innovation*, because both sorts of change are necessary if society is to move on to a more sustainable pathway.
- *'learning-by-doing'*, developing experiments with novel practices and technologies, because it is only by initiating change that we can learn the potential (and the limits) of different approaches.
- *tailoring support for technologies to the different phase of the innovation cycle.*
- *encouraging a diversity of innovations ('variation') and competition among different approaches (selection)* to fulfil societal needs.
- *assigning an active role to government* in mobilizing society to orient change in desired directions.

Transition management complements existing policy and seeks to change it. It does not necessarily intend to replace mainstream policy; the two processes can 'co-exist' with transition management acting as a "meta-level instrument to transition a regular policy context" (Loorbach, 2007: 272), for example by starting with a "strategic transition arena on a small scale to explore alternative visions in an area where innovation and innovative visions are scarce" (ibid: 291). This is also referred to as the 'two-track approach'[9]. With time, patience, and a bit of contingency, the transition movement may spread out and have transformational influence on the mainstream policy. While this type of 'transitioning' aims primarily at (government) policy, it also affects ongoing projects at operational levels, as one 'transitioning strategy' is to "build on existing projects and experiments to transition these and by broadening and scaling-up and (re)defining visions" (ibid: 291-292: emphasis added).

To us the model is an attractive model for sustainable mobility policy. We think that the reliance on evolutionary processes of variation and selection and retention is appropriate for sustainable transport policy which should have a forward-looking element but also has to evolve with practical experience. Planning based on anticipatory rationality has been shown to produce many undesirable results (March and Olsen, 1995; Scott, 1998). At the same time, some element of planning is required to inject collective goals in the market process, which is oriented towards short-term economic gains instead of longer-term optimality (Kemp and Soete, 1992). To avoid the 'modernistic mistakes', one might start with acute problems (Lindblom, 1959; Meadowcroft, 2005) such as congestion, noise and urban air pollution. A difference with existing policy is that one does not seek those problems individually, through particular measures, but looks for systemic solutions.

[9] 'Transitioning' and the 'two-track approach' are much less elaborated than the full-fledged TM-model, and are currently being studied both theoretically and empirically by Van der Bosch and Van Raak.

Systemic solutions can be developed in close interaction between stakeholders from different backgrounds. Many transition initiatives in the field of sustainable mobility in the Netherlands are currently undertaken in partnerships between business, government and universities (see for instance Etzkowitz 2003). These partnerships require effort and input from all partners, which places government sometimes in a double role. On the one hand, they are involved in the reproduction of the regime (for instance, through road extension projects in the case of automobility), on the other hand, the government takes part in initiatives to change the regime. Although this may represent challenges for the partners, in practice it does not always result in trouble. When it goes well, major benefits arise from this partnership. The involvement of social, political, economic, and scientific partners means support for change is likely to be much higher than for changes developed in individual settings. This relates closely to transition management concepts such as the transition arena. Governmental policy is part and parcel of the process of change. In the Netherlands transition thinking has been used by the national government, which is why it is important to look at how it has been used and what it has achieved so far.

4. The use of Transition Management thinking in three domains

Originally the 'transition to sustainable mobility' was subsumed under the transition to sustainable energy, one of the three 'necessary transitions' mentioned in the 4th Dutch National Environmental Policy Plan in 2001. Subsequently, 'transition-to-sustainable-mobility' emerged as a combination of words that has been increasingly used throughout the Netherlands. Besides the research community around transition studies and transition management, a variety of policy-makers, business-representatives and NGO-representatives refer to this 'transition to sustainable mobility' in both written and spoken word. One can distinguish between four main settings in which the concept of transition (management) appears in relation to sustainable mobility: a) national mobility policy, b) transition research on sustainable mobility, c) the Dutch 'energy transition' and d) the innovation programme Transumo (Avelino & Kemp, 2008). In this subsection we shortly discuss how the concept of transition (management) appears in these settings. The aim is to give an overview of how transition management concepts emerged in Dutch mobility policy, how researchers and practitioners attempted to apply these concepts to the mobility sector, and how these concepts subsequently manifested itself in various policy documents, research programmes and innovation projects.

4.a. The Ministry of Transport and Dutch Mobility Policy

Details of the use of transition management by the Ministry of Transport and Water are described by Nooteboom (2006), who states that the support for transition management initially was weak within the Department for Transport of the Ministry. Instead of creating a transition platform, an 'innovation board' ('Innovatieberaad') was established informally in 2001 by a handful of civil servants. It was an informal network (until 2004), with no budget and little decision-making power. In the first 3 years they focused their attention on organizing an EU conference for which they developed a set

of 'roads to sustainable mobility'. The network was widened to include representatives of the ANWB (a Dutch organisation representing the interests of road users and tourists), Toyota, Shell, and an environmental NGO. The mind map representing these 'roads to sustainable mobility' was perceived by the members of the innovation board as a breakthrough (Nooteboom, 2006, p. 124). The innovation board allowed for informal discussions and mutual learning. The members were careful not to cause tension with the Ministry, Shell or the automotive industry. Only the members of the innovation board, and sometimes their superiors, could see the significance behind the scenes of the innovation board (Nooteboom, 2006, p. 125).

The 'transition to sustainable mobility' was mentioned in the cabinet's Mobility Policy Document ('Nota Mobiliteit', hereafter referred to as the Policy Document). This Policy Document was developed, presented, discussed, adapted and formalised between 2004 and 2006 in cooperation between the Ministry for Transport and Water (V&W) and the Ministry of Housing, Land-use Planning and Environmental Management (VROM). It discusses (amongst others) the transition to sustainable mobility and mentions transition management as an innovation strategy for the long term, which the cabinet chooses in order to "achieve sustainable mobility (...) with a long-term time horizon and – related to that – innovation programmes (...) for the short-term".

In September 2004 the first section of the Mobility Policy Document mentioned the transition concept seven times, introducing it under the chapter on "quality of life and sustainable mobility", with the following text:

> The environmental policy of the past 30 year showed good results on many fronts. Great environmental improvements have been initiated for motorised mobility. However, one cannot say that the bottlenecks will disappear for all environmental issues. The goal for the long-term (2030-2050) is that the harmful effects of mobility on its surroundings will be brought back to nearly zero. This cannot succeed if we keep holding on to the current state of the technology. Especially since traffic and transport will still increase considerably. The only way to bridge this gap is through a transition to a completely new concept for our traffic and transport system. That does not only involve large scale innovation in the field of fuel and motor technology, but also organisational and societal innovations, that together bring about a world-wide system innovation in the field of transport. (p. 118).

In May 2005 the second section was published, which contained the results of the public comment and advisory trajectories. In September 2005 the third section – also known as the 'Cabinet's position'– of the Policy Document on Mobility was published. Therein the use of the word 'transition' almost doubled (from 7 to 13 times). This was mostly due to the addition of text boxes with several 'future visions' for 2030 (e.g. congestion policy in 2030, public transport in 2030, logistics in 2030, and etcetera). In each future vision the 'transition paths' towards that future vision were specified. The language of 'transition' and 'sustainability' was mostly used in relation to energy and climate policy.

More than half a year later, in April 2006, the fourth part of the Policy Document on Mobility was published. The title of the official English translation (June 2006) is 'Officially adopted Policy Document'. Interestingly, while the earlier versions explicitly mentioned the 'transition to sustainable mobility', this shorter 'officially adopted' Policy Document no longer mentions the word 'transition'. The word sustainable is reduced to only four usages. From this one may draw the conclusion that there is not a

strong commitment to transition management for sustainable development at the level of national mobility policy.

In the white paper 'Mobiliteitsaanpak' of October 2008, an investment agenda framework document about mobility policy, the term "transition" enters again.[10] A discourse analysis of this document learned that the term transition is used once, far less than the terms sustainability ('duurzaam') and sustainable ('duurzame') which are used 14 and 15 times. In this document the term "innovation" is used 35 times. What this shows is that the terms sustainability and transition come and go. Both terms suffer from fluctuating and fragile degrees of attention.

What this also demonstrates is that, despite the fluctuations, the Ministry is involved with transition management and sustainability. Given the rather recent and still ongoing development of TM this is noteworthy, as applying an approach that still possesses the uncertainty of all new scientific approaches is risky for a ministry. Application of TM at the Ministry is not highly elaborate, or intensively applied. It is one of several perspectives that play a role in policy. From interviews with, among others, project leaders of innovation programme Transumo and employees of the Ministry it appears that a certain interest in sustainable mobility and transition concepts exists, but that this interest is coupled with concerns about the downsides of these matters. Sustainability and, especially, transition management are often seen as too abstract, too vague, and too normative for application in everyday practice. On the other hand, the awareness that a long-term perspective is needed for the needed reforms of the mobility sector also means that these concerns have not led to a strict rejection of TM. One thing that this teaches us is that TM has to connect better with the needs and language of national government, and hence make the application of TM more structural.

4.b. The Dutch Energy Transition

The 'Sustainable Mobility Platform', is one amongst various other platforms that together realise the Dutch 'energy transition', which is the official name for the new approach by government to realise a sustainable energy system (Min EZ, 2001, 2002, 2003, 2004). This energy transition is overseen and coordinated by the 'Interdepartmental Programme Directorate of the Energy Transition' (consisting of six ministries) and a 'Taskforce Energy Transition' (composed of representatives from 'the top of business community, the government, research organisations, banking, and NGOs). The Sustainable Mobility Platform was created in 2005, to define transition paths and experiments towards sustainable mobility.

The platform is composed of representatives from government, an environmental NGO, the ANWB, and business representatives (including Shell, BP Netherlands, Peugeot Netherlands and DaimlerChrysler).

Within the platforms people investigated (technological) innovations for sustainable mobility. On the basis of the deliberations four transition paths were chosen, deemed interesting from a business and sustainability perspective:

[10] Mobiliteitsaanpak contains the new policy plan for action of the Ministry for Transport and Water. One important element is an investment agenda until 2020 of 7 billion euro, 4 billion more than the planned investments in the "Nota Mobiliteit" from 2006.

- Hybrid and electric vehicles
- Biofuels
- Hydrogen Vehicles
- Intelligent transport systems

The activities of the Sustainable Mobility Platform are part of the energy transition process. The chairs of the platforms meet with each other, in the Regieorgaan EnergieTransitie, to discuss cooperation and policy issues. For policy coordination a special ministerial working group has been set up: the aforementioned Interdepartmental Project directorate Energy transition (IPE), created in 2005. Within IPE issues of policy coordination are being discussed and dealt with by the secretary generals of six ministries: Economic Affairs responsible for innovation policy, energy policy and economic policy, Spatial Planning, Housing and Environment (VROM) responsible for the environment, Transport, Public Works and Water Management (V&W) responsible for mobility, Agriculture, Nature and Food Quality (LNV) responsible for agriculture, fisheries and nature development, Foreign Affairs (BuZA) responsible for foreign development aid and biodiversity, and Finance, responsible for the financial aspects of the energy transition.

The platform's choices are not limitative for innovation in the area of sustainable mobility. New initiatives may emerge outside the platforms through parliament or because certain powerful parties in society are able to secure policy support for it. An example is the programme for battery electric vehicles which was defined by a coalition of NGOs, business (Essent, Better Place), finance (ING, Rabo) and the Urgenda, a coalition for sustainability action, who successfully lobbied ministers and parliament to give special support to BEVs. The Sustainable Mobility Platform was critical about the programme; it considered the hybrid-route more promising given the present state of development of batteries and thought that the goal of one million battery electric cars in 2025 was unrealistic. However, it is working constructively with this initiative (interview with secretary of Sustainable Mobility Platform Remco Hoogma on 23 July 2009).

On the whole it seems that policy coordination has improved in the last five years (between 2005 and 2010). For example, battery electric vehicles, hybrid electric vehicles and other low-emission vehicles are subject to special fiscal treatment.[11] There is more cooperation between ministries and between government, business, research and civil society. There is also more cooperation between national initiatives and regional initiatives.

The whole energy transition approach is set up as a vehicle for sociotechnical change and policy change in a coordinated manner. This is evident from the activities of the Regieorgaan and the platforms for 2009.

[11] In the Netherlands many vehicles are leased from companies. People driving a leased vehicle must add 25% of the value of the car to their income before taxes and pay taxes over this extra sum. If you lease a battery electric vehicle, 10% of the value of the car is subjective to income taxes; for hybrid electric vehicles it is 14%. Charging points are up for a fiscal advantage of 20%. The tax incentives for cars proved very effective: in the first 5 months of 2009, 7456 hybrid electric cars were sold in the Netherlands, an increase of 63% compared to the same period in 2008. Between 2008 and 2009 the number of HEV doubled: from 11,000 to 23,000.

As one can see the platforms produce advice, they take stock of what has been achieved, they commission studies and they are involved in all kinds of institutional alignment activities (also between the platforms). The platforms are currently working with municipal authorities and national government to create pilots for energy neutral living districts to learn about alternative energy systems (with the systems going beyond particular technologies from the platforms) and to create visibility for the energy transition.

Table 1: Planned activities of the various transition platforms in 2009.

Platform	*Planned activities in 2009*
Regieorgaan	– Production of an official advice on policy, in which they make recommendation for instrument choices
Green resources	– To follow the implementation of sustainability criteria for biomass – Position paper on CO2 allowances for biomass – To launch an explorative study into the macroeconomic effects of biomass production and use in the Netherlands – To develop a systematique for measuring green resources
Sustainable mobility	– To make recommendations for fiscal treatment of clean vehicles – To discuss the action plan on alternative mobility with leasing companies – To examine how natural gas and green gas may pave the way for hydrogen – Evaluate experiences with buss experiments funded in the first tender – To offer advice on how public transport concessions may be used for innovation – To assist in the implementation of 5 pilots about smart grids and electric mobility – To launch or stimulate pilots for sustainable biofuels (high blends and biogas) and hydrogen in five cities in cooperation with Germany and Flanders in Belgium
New Gas	– To investigate product-market-combinations for decentralised gas use – To commission or undertake a study into the potential of gas motors and absorption heat pumps
Chain efficiency	– Starting the first phase of the programme for precision agriculture – Working out a development plan for process intensification
Sustainable Electricity Production	– Formulate platform positions on off shore energy – Rules for co-burning of biomass, cogeneration, and conditions for coal-fired plants – Implementation the earlier formulated action plan Decentralised infrastructure (smart nets) – To examine and utilise opportunities in blue energy
Built environment	– Platform advice about the restructuring of existing business parks – Workplan (script) for achieving energy saving using a district-based approach. – Investigation of how local authorities may be involved, on a voluntary and less voluntary basis.

Source: Energietransitie. Duurzaam doorgaan.

As one can see the platforms produce advice, they take stock of what has been achieved, they commission studies and they are involved in all kinds of institutional alignment activities (also between the platforms). The platforms are currently working with municipal authorities and national government to create pilots for energy neutral living districts to learn about alternative energy systems (with the systems going beyond particular technologies from the platforms) and to create visibility for the energy transition.

Various initiatives for sustainable mobility have been undertaken and supported by the Sustainable Mobility Platform. It is interesting to see that in its own description of its purpose the Sustainable Mobility Platform does not speak about 'the transition to sustainable mobility', but rather about 'the transition to a sustainable energy supply'. Next to that, the text on the platform's website states that the platform aims to ensure 'affordable and independent mobility' *as well as* 'sustainability' as two separate things, rather than mentioning 'sustainable mobility' as one goal.

It is unclear to what extent the Sustainable Mobility Platform has impacted the Dutch mobility sector so far, and to what extent this points to an application of transition management and long-term sustainability goals. The platform does not have an explicit vision of what sustainable mobility is or should be. The stated goals of the platform are:

- Factor 2 reduction in GHG emissions from new vehicles in 2015.
- Factor 3 reduction in GHG emissions for the entire automobile fleet 2035.

This shows that it very much oriented towards cleaner cars and not so much to the other elements of sustainable mobility noted in Section 1.

4.c. The innovation programme Transumo

The third context in which transition thinking has been applied is the innovation programme Transumo. Transumo is an abbreviation for 'TRAnsition to SUstainable Mobility' and was founded in 2004. 150 organisations from the public, private and 'knowledge' sectors collaborate in applied research within well over twenty innovation projects related to transport and traffic. On its website, Transumo describes its mission as follows:

> "(...) to accelerate/encourage the transition to sustainable mobility. This will be achieved by initiating, and establishing for the long term, a transition process that leads to the replacement of the current, supply driven, mono-disciplinary technology and knowledge infrastructure, with a demand driven, multidisciplinary and trans-disciplinary, participative knowledge infrastructure."[12]

The Transumo-organisation is part of a broader national programme to improve the 'knowledge infrastructure' by encouraging and subsidising research programmes that specifically aim for applied, multidisciplinary science at the interface between knowledge and practice.

Transumo cooperates with transition researchers from the KSI research programme, a 20 million Dutch research programme about transitions (in which we ourselves are involved). Transumo organised various workshops and sessions on how to be open to learning processes and deal with the challenges of the transition to sustainable mobility and the application of transition management. During these workshops managers and participants from different projects presented their concrete challenges and dilemmas to each other, and 'transition researchers' were invited to help structure the discussion and offer suggestions on how to move on). For example, in a joint workshop project managers were asked to reflect on the following questions:

[12] http://www.transumo.nl/Nl/Organisatie/Missie.aspx

- Does the project offer a contribution to a societal problem (challenge)? Which challenge is this?
- Is it informed by a vision of sustainable mobility? Is it designed to learn about this vision?
- Is it part of a transition path? If so, what path?
- Is it oriented towards demonstration or learning? Does it learn about sustainability aspects, markets, how various actors may be enrolled and how the project may be scaled up?

Transition aspects are also addressed through a reporting format: project-leaders have been required to report whether and how their project 'contributes to the transition to sustainable mobility', and how transition management is applied.

These questions and interactions with transition researchers helped people involved in Transumo projects to reflect on their project in a novel way. This was found a useful exercise by some but not by all. In general the transition concepts are still something project-leaders struggle with. In some cases it appears that they use transition terminology because they are expected to use it (by Transumo), rather than because they want to use it. Even sustainability, which is also in policy much more often used than transition, is often not a big concern to many project participants. Attention for sustainability has often been brought to the project by the efforts of Transumo and of the project-leaders. Transition is in many ways a 'bridge too far' for a share of the project-participants, and even for some project-leaders. Some project-leaders find it difficult to talk about future visions, and even more project-leaders struggle with the concept of 'transition paths'. This does not mean that they are not working on a transition to sustainable mobility, but rather that their use of words and framing is not explicit about this.

5. Summary

In this article we offered a discussion on the question why despite of serious problems connected with the use of cars it has proved so difficult for policy makers to deal with these problems. It was stated that government officials could benefit from a "transition approach" which is informed by visions of sustainable mobility, with learning and adaptation as key element. Transition management is not so much an instrument but rather a new mode of governance for sustainable development, aimed at resolving persistent problems in societal systems, based on visions about how mobility needs can be met more sustainably. These processes of societal change, transitions, exist in a complex, multi-actor and multi-level setting with diverging time scales and actor interests. In these complex societal systems change is not simple a matter of planning and management. Transition management starts off from the premise that full control and management of societal problems is not possible, but that we can 'manage' these problems in terms of adjusting, adapting and influencing the societal system by organizing a joint searching and learning process, focused on long-term sustainable solutions (Rotmans, 2005; Loorbach, 2007). One of the ambitions of transition management is to connect innovative minds and enable them to integrate "long-term governance activities into the realm of policy-making" (Loorbach, 2007: 104). The

transition management literature offers several management principles and instruments to help organise such a process, including participative process tools such as integrated system analysis and scenario exercises (Loorbach, 2007: 114). These different instruments and principles are captured in a cyclical process model (as we described in Section 3).

In recent years the transition management approach has gained a great deal of attention from policy-makers, managers and other practitioners in the Netherlands. It has been applied in various policy contexts, and to various programmes and projects (Loorbach, 2007). In 2001 the concepts of 'transition' and 'transition management' were presented in the 4th Dutch National Environmental Policy Plan (NEPP4). In the last eight years, The Ministry of Economic Affairs started using it to change its relation with business and to have a more active agenda for energy innovation, aligned with climate policy and business creation goals.

Despite of these developments, there has been relatively little active support for transition management within the Ministry of Transport, Public Works and Water Management (Nooteboom, 2006). In Section 4 we described that even though concepts such as 'transition' and 'sustainable' were initially addressed and discussed as an explicit aim of mobility policy, most of these ideas did not survive the last round of policy deliberations resulting in the 'Officially adopted Policy Document' in 2006. Despite of the relatively weak formal support for transition management within the Department for Transport, the idea of 'a transition to sustainable mobility' has emerged and spread throughout the Netherlands, amongst a variety of policy-makers, business-representatives and NGO-representatives. Attention for a transition to sustainable mobility has primarily manifested in the context of 'the Dutch energy transition' (in the form of the Sustainable Mobility Platform) and in the context of the innovation programme Transumo.

This article has shown that the transition storyline has some positive power, because it has been used in discussions about societal change and motivated several transition initiatives, but that the TM-approach so far has not been firmly rooted in policy and governance. TM requires a process of re-institutionalisation in which more attention is given to sustainability visions for mobility. The use of the term transition may help to articulate the complex challenge involved in moving away from present transport practices and assist in the creation of a bottom-up and top-down process of change. Details of what to do must be defined at different levels by different actors; TM is not a tool but a framework for thinking and decision-making. The transition perspective holds that policy should be less concerned with short-term outcomes and more concerned with long-term outcomes. Institutional capabilities and knowledge have to be created for this. Sustainable mobility is likely to require different knowledge and expertise than currently is being used. It helps to insert greater reflexivity in systems of governance which is a precondition for sustainability mobility.

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Personal Carbon Trading and fuel price increases in the transport sector: an exploratory study of public response in the UK

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Abstract

Large reductions of greenhouse gas emissions are required in order to avoid the worst impacts of climate change. Road transport is a significant contributor to UK CO_2 emissions, with the majority arising from personal road transport. This paper analyses Personal Carbon Trading (PCT) as a potentially powerful climate change policy tool and presents findings from an exploratory survey of public opinion: A working model of a PCT scheme with a fixed carbon cap was designed to achieve a 60% reduction of CO_2 emissions from personal road transport by 2050. A proportion of the annual carbon budget would be given to individuals as a free carbon permit allocation. There is an opportunity to sell unused permits. Fuel price increases (FPI) were recognised as having the potential to achieve an identical emissions target at a much lower cost.

A series of individual interviews were conducted to explore opinions related to the impacts, effectiveness, fairness and acceptability of both measures. Bespoke software was used to record behavioural response. The findings indicate that certain design aspects of the PCT scheme led to it being preferred to the FPI and suggest that the potential behavioural response to PCT may be greater than for a FPI. However, given that the sample was small and biased towards the highly educated and those with above average incomes, the findings should be considered as preliminary indications. Further detailed research is required.

Keywords: Climate change; Transport; Personal Carbon Trading; Fuel price increases; Public opinions.

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