8 Sociotechnical transitions governance and public engagement

Introduction

In the previous chapters, we have addressed ways in which various psychological perspectives can be more or less closely connected to sociotechnical transitions theory, but we have not considered issues of public engagement in – and consultation on – such transition policies and their development. In general, both in research and among practitioners of environmental management and planning, including energy infrastructure planning, some form of public engagement and consultation are perceived as desirable (Raven *et al.* 2012). Yet among the multiple stakeholders in such processes, what forms these processes should take, and what their formal role should be in decision-making and policy processes has been greatly contested. All of this is strongly connected to issues of power, which have been given increasingly (but arguably still insufficient) explicit attention in the transitions governance literature (Avelino and Rotmans 2009; Avelino and Wittmayer 2016).

This chapter draws on some of these issues through a study, by Upham *et al.* (2015), of public perceptions of low carbon transport innovation policy options in Finland. It does so leaning on the results of a large-scale survey on the Finnish land-based passenger transport sector, as this might develop for a lower carbon future. More broadly, this study focuses on and discusses the engagement of publics as key stakeholders in sociotechnical transition processes. In this regard, the notion and role of transitions management (TM) is centrally discussed.

Overall, the study highlights the differentiated nature of public support for innovation policy for low carbon transport, and it suggests that accounting for these differences is a precondition for securing the broader social legitimacy of TM processes. Drawing upon the survey-based evidence from within this one exemplar country, we show how transport practices and attitudes to transport innovation policy vary widely with both demography and geography, and discuss the way in which differences in public opinion might hinder or complicate transition-related policy-making. We argue that such knowledge matters for the effectiveness – or at least legitimacy – of policy design.

We also suggest that particular forms of public opinion surveying can provide a relatively inexpensive way of obtaining information about the (potential) sub-national and regional differences in public opinion in relation to specific initiatives. Such knowledge may be deepened through iteration: i.e. using the responses from one survey to refine questions in follow-up surveys; through the involvement of specific, potentially impacted population groups in the design of questions; and, more generally, through the use of the various methods of opinion elicitation commonly used in the social sciences and in political research. This in turn raises many normative issues, which we touch on, including the relative weight that should or might be given to the views of technical experts, lay publics, elected political representatives, state agencies and commerce in policy and TM processes.

Transitions management

Overall, the ambition of TM implies moving beyond just stakeholder *consultation* in policy-making, towards engaging stakeholders actively in these processes, giving weight to their views and working towards more sustainable prescriptions for policy and practice that have wide societal support. In this way, TM is intended as a socially participative approach to the governance of sociotechnical transitions towards environmental sustainability (Kemp *et al*. 2007; Loorbach and Rotmans 2010). Conceptually, TM is conceived of as a form of multi-level governance in which state and non-state actors are brought together to co-produce policies with the aim of co-ordinating science, innovation and sectoral policy (Kemp *et al*. 2007). While TM offers analytic concepts and descriptive characterisation of sociotechnical change processes, the approach is also prescriptive, offering designs for sustainability governance (Loorbach 2009). It departs from (and extends) the innovation studies literature by its explicitly normative stance, and it adopts sustainability as an explicit objective. Practical and theoretical work with TM has continued most strongly in the Netherlands (e.g. Frantzeskaki and de Haan 2009; Loorbach and Rotmans 2010; de Haan and Rotmans 2011; Frantzeskaki *et al*. 2012), but it has also drawn on empirics relating to transitions experiments elsewhere (e.g. Nevens *et al*. 2013; Nevens and Roorda 2014). Conceptually, the approach is rooted in innovation studies (Geels and Schot 2007); a modest number of academic papers that are centrally about TM are published annually, with a mean of 15 papers per year published between 2015 and 2018.[1]

Public participation in sociotechnical innovation

For several decades, science and technology studies (STS) theorists have argued for more authentic and deeper public engagement in technology innovation research processes, arguing that this would serve as a means of

enhancing the legitimacy of innovation processes (e.g. Wynne 1973; Sclove 1995). Indeed, 'public participation' and 'local engagement' have long been on the agenda of many specific practical and academic domains – including in the transportation planning domain that is of relevance here (e.g. Wellman 1978).

Such 'participation' has long been discussed in multiple contexts and in all senses of 'the public', from individuals or local publics, through to civil society in a variety of settings, from technology design through to technology use (Nahuis and van Lente 2008). Yet the question of *how* to meaningfully engage publics in processes of both scientific and technological innovation remains (Macnaghten and Chilvers 2014). Moreover, all too often this question is addressed in very general terms that do not address the importance of local heterogeneities or acknowledge the power-related issues involved. From the perspective of policy legitimacy theory, public participation in policy-making, and the subsequent demonstrable transparency of those processes, should support and promote stakeholder perceptions of procedural legitimacy (Suchman 1995). In this context, legitimacy can be broadly defined as: "a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions" (Suchman 1995, p. 574). Procedural legitimacy of policy thus relates to the *process* by which this policy is made, while stakeholder perceptions of the more general legitimacy of the State rests on their overall beliefs in its rightfulness and moral authority (Barker 1990; Upham and Dendler 2014). Here, we address the question of how to achieve and promote procedural policy legitimacy for innovation policy via public engagement, and we do this from the perspective of TM. Our premise is that there are different degrees of legitimacy, and that these differing degrees may be achieved among different groups within society.

There is another issue that is relevant here: geography. In its search for generally applicable theories and concepts, sociotechnical transitions theory has been critiqued for inadequately addressing the spatial/geographical aspects and specificities of transitions dynamics (Coenen *et al.* 2012). As we show below, geography, or more precisely the very specific local contexts in which transitions processes take place, can be important for the character of public opinions towards those changes in local areas – and hence also for the results of efforts to create policy legitimacy regionally. Efforts at introducing geographical dimensions in sociotechnical studies include those by Coenen *et al.* (2012) and Raven *et al.* (2012). These authors have emphasised the importance of relational, network-based aspects of transition: actor networks that are made possible and reinforced by co-location, that is, locations in in some way connected to one another, typically through physical proximity. While there is some work on introducing spatiality into transitions thinking, we see little or no work in the transitions literature on the role of geographically-based

differences in public opinion, the implications of such differences for 'managing' these transitions and implications for national (or regional) policy.

In this study, our focus emphasises the need to account for geographical and other differences among 'the public' or publics when seeking to engender policy legitimacy in transitions processes. With the exemplar sector of land-based passenger transport, the chapter discusses the nature of differences in public opinions of state policy options for sociotechnical innovations, and it specifically addresses the way in which such differences are geographically influenced. Leaning on these research insights, the implications of differences in opinions among publics for governing the transition of the transport sector are discussed – particularly regarding public engagement and its legitimating role for these processes, and regarding which types of sociotechnical innovation may be favoured and accepted. In this respect, we argue that heterogeneity in public opinion has implications for achieving policy legitimacy and that this is obscured by a focus on broader majority opinion alone. Accordingly, we suggest that the iterative and participative use of opinion surveys can play *a* role in engaging the public in the social participation that TM envisages, but only provided that these are undertaken in a manner that is mindful of the power relations involved and with transparency regarding the degree of influence that the participating publics may expect.

Theory

Transition management and public engagement in innovation policy

TM is a response to the view that neither central planning by governments nor market forces are sufficient to bring about the types of change that complex, persistent and interconnected social, economic and environmental problems require (Loorbach 2009). As an approach to governance, TM proposes and applies "an instrumental, practice-oriented model" in order to influence ongoing sustainability transitions through reflexive and evolutionary governance (Markard *et al*. 2012). The perspective is systems-based: it assumes that social, technological, economic and other phenomena and actors are connected more or less directly, and therefore that interventions or pressures at one point in the system may induce or influence change elsewhere in the system.

The need for reflexivity that TM emphasises is in part analytical, but also normative in its underlying (if tacit) democratic principles. Moreover, in TM the networks that social, economic and governmental actors form and foster are not treated uncritically, but seen as potentially (Hendriks 2008, 2009) involving limited transparency and accountability (Loorbach and Rotmans 2010). As an ideal, TM is an attempt to increase the broader social legitimacy and effectiveness of new forms of governance by: (a) offering a

structural perspective on system change that itself builds on a multi-level perspective (MLP) of interconnected social and technological change (Rip and Kemp 1998); and (b) proposing and testing new fora and methods of governance, particularly bringing together different actors and/or actor perspectives on transitions (Upham *et al.* 2015).

Some key concepts from TM have been outlined above, but there are further issues that should be considered before setting out a basic proposal for public engagement in TM. For this purpose, Upham *et al.* (2015) draw selectively on a categorisation of engagement issues by Delgado *et al.* (2011). First, *why* pursue public engagement at all? In a very instrumental sense, early public engagement seeks to minimise or, indeed, eliminate opposition towards the projects or processes at hand by attending to and addressing questions and queries from publics and/or other stakeholders at the earliest stage possible. In some instances, dependent on and reflecting the project type and scope, public engagement and participation initiatives are open, explorative and creative, and some may sport an ideal of collaborative project design and a relative balance of power between the parties involved. Arguably, however, such cases are rare. Public engagement in its most limited form may consist of public consultations, and these are more common. While many organised public engagement processes in scientific and technological development are arguably not intended as mere consultations, but also as processes of two-way communication, inspiration and dialogue, sometimes these activities nonetheless resemble one-way information provision, i.e. consultations. Despite the limitations of such consultations (intentional or not), effective and well-planned one-way dissemination of information still does and will continue to play a role in the process of generating socially shared visions of the future in TM and processes of policy-making.

Second, *who* should participate, i.e. which 'publics', which segments of the population, and how and by whom are these participants recruited? These are also pivotal questions in any public engagement and participation activities. If broad public representation is a given objective in engagement endeavours, then stratified polling (the systematic selection of respondents that provides a demographically representative sample of the selected population) is ideally required (Rowe and Frewer 2000). Sometimes, narrower demographic or geographic population segments may be relevant for the participation processes and, in such cases, more exploratory work is perhaps merited. Hence, a broad or narrow scoping of surveys can, for example, be used and qualitative work (interviews, focus groups, ethnography, etc.) may also help to reveal themes or characteristics of interest that can then be followed up with additional survey work.

Third, *how* the terms of engagement are decided upon may vary. Initially, deciding upon relevant topics and questions of interest can be determined in partnership with affected populations and/or other relevant stakeholders. Such discussions will likely increase the legitimacy of the

results and outcomes due to the enhanced transparency of the process (Rowe and Frewer 2000).

Fourth, *when* the engagement should take place (at what point in the development of a given process it takes place) will depend on the purpose, context and constraints of the situation. An affected population may prefer early and ongoing involvement in the decision processes, and indeed maximum influence over those processes, but this may or may not be politically and institutionally possible (or perhaps desirable, depending on one's view – and on the technical/legal requirements of a particular project). In principle, early engagement gives more time to shape decision-making. Ultimately, however, 'engagement' in decision-making processes at any stage is only true engagement if there is full transparency as to the actual level of influence on the outcomes of (perhaps certain parts of) those decisions that is practically possible – and/or desirable.

Figure 8.1 brings these considerations together with the ideas of TM. First, increased public engagement may or may not, on the one hand, facilitate a particular transition, not least because increased debate may also complicate argument closure. On the other hand, insufficient debate may lead to additional dissent and objections among members of the public that it may have been easier to deal with at an earlier stage in the innovation process. Second, public opinion on the transition processes influences transition drivers and dynamics at all stages, positively and negatively, and this influence will persist regardless of any ambitions for TM – inclusive of participation processes. Moreover, members of the heterogeneous public, or publics, will sometimes emphasise their different roles – for example, as citizens, consumers or civil society actors with a more consciously political role.[2]

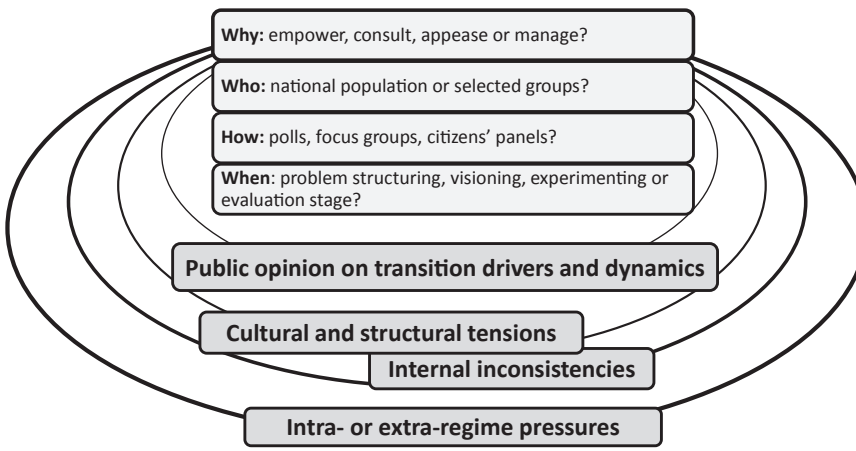

Figure 8.1 Public engagement and transition management processes.

Having outlined some differing rationales for public engagement in TM and some basic methods for how this might take place, we now draw on a case study by Upham *et al.* (2015) for illustration. This study shows how public opinion on low carbon innovation policy options for the land-based passenger transport sector in Finland is demographically and geographically differentiated. The work is experimental, rather than part of a live policy process, but nonetheless the detailed empirics illustrate the types of opinion difference that may influence a future TM process.

Case study

The research design is exploratory and inductive, the aim being to explore the governance implications of diverse public opinions for public engagement relating to specific transition processes. The selected samples of public opinion are from three different work-to-travel areas in Finland. The specific objectives of the study were: (1) to reveal public opinion on transport innovation and innovation policy options; (2) to identify the nature of any differences within the selected populations; and (3) to provide an empirical basis for further discussion of public engagement in TM processes.

The survey was part of a wider project on low carbon, system level transitions for transport (Temmes *et al.* 2014). Public opinion was elicited with an online survey instrument designed to take 20–30 minutes to complete, and the full sample consisted of 1,000 people split equally across the contrasting travel to work areas (TTWAs). The survey was administered by a market research firm. In each TTWA, demographic representation was sought in terms of gender, age and social class. The TTWAs selected were the Helsinki, Tampere and Oulu regions of Finland. These represent a capital city with an extensive public transport system including metro, trams and buses (Helsinki); a regional city with a bus system (Tampere); and a smaller, more peripherally- and rurally-located city with a bus system (Oulu). In the study, the selected TTWAs were assumed to have differing patterns of transport use, mirroring the different public transport infrastructure availability in those places and possibly different perceptions of innovation priorities that reflected different economic interests and outlooks among the respondents. In particular, it was hypothesised that views in Oulu would differ from those in Helsinki and Tampere and, as we show, this was indeed found to be the case.

Question design represented a range of technological, behavioural and legislative change and transition options, reflecting previous transitions work on transport (Geels 2012) and on 'sustainable' transport policy options (Banister 2008). In particular, both 'soft' and 'hard' transport policy and innovation options were included: those that involved social and institutional innovation (soft), as well as those in which innovation is primarily technological (hard). Other relevant opinion surveys were also

taken into account (e.g. EC 2011), as well as relevant reports on future transport and mobility options (McKinsey & Company 2009; VTPI 2010; VTT 2012; European Climate Foundation 2013; PE International 2013). The questions also reflected the way in which "[t]ransport and travel choices are rooted in the structure of activities undertaken by individuals and families", and "attitudes to transport must also be rooted in deeper values and aspirations of how people want to lead their lives" (Goodwin and Lyons 2010, p. 16). Hence questions on respondents' everyday transport habits and practice and on environmental attitudes/values were also included in the questionnaire.

A key premise of the survey design was that different degrees of dependence on differing transport modes may affect attitudes to transport innovation policy options and, in a similar vein, that differences between the selected TTWAs, such as prevalent types of economic activities in these locations, may also have an effect. Helsinki, on the southern coast of Finland, is a cosmopolitan capital city with an extensive bus, tram and metro network and a climate that, while hardly mild in winter, is milder than further north. Tampere is a regional city 90 minutes north of Helsinki by train, and it shares many of the same characteristics as Helsinki, albeit on a smaller scale. In contrast, Oulu is climatically sub-arctic. This city has shorter internal transport distances, and it has a smaller mixed economy that combines high tech start-ups with port logistics and materials processing (notably wood and steel).

The survey results regarding the different ways in which the Finnish state might support low carbon innovation policy for sustainability transition in personal transport show significant opinion differences that are linked to both demography and geography. Table 8.1 highlights some of the implications of the differences for public policy legitimacy, and it does so in Suchman's (1995) broad sense of the word 'legitimacy'. Table 8.1 distinguishes between aggregate opinion, presented first, and opinion differentiated by geography, gender, age and income.

Earlier in the chapter, we argued that there are multiple choices to be made regarding the motives and modes of public engagement in transition processes. We also argued that public opinion is likely to impinge on transition processes in any case. In Table 8.1, we can see examples of how this influence might become manifest in terms of citizen support for public policy with the example of the transport sector. First, at an aggregate level the sample population (1,000 people) can be characterised as somewhat conservative, valuing incremental technological innovations such as more fuel-efficient conventional vehicles, biofuels and hybrids, but valuing public transport related investments too.[3] Most respondents accept that changes are required to mitigate climate change impacts, but a significant minority do not. Climate scepticism, defined in the questionnaire as disagreeing that "the world's climate is changing due to human activity this century", is stronger outside the capital city and among men generally.[4]

Table 8.1 Selected survey results and implications for policy legitimacy and transition management

Survey result	*Issues and implications*
Aggregate survey results	
Strong public approval for variants of the private car.	Policy supportive of incremental innovation has relatively strong public support, potentially complicating consensus-based vision building at all levels of TM.
Most use a car frequently, but support innovations that facilitate public transport, cycling and walking.	Indicates support for policy that is inclusive rather than exclusive of options, supporting vision building and culture change at the strategic level of TM.
Electric vehicles are seen as important but do not have the same level of broad support as biofuels.	Relative to electric vehicles, State support for Finnish sourced, second generation biofuels may garner a higher level of overall public support in the short to medium term, disfavouring TM processes supportive of electric transport.
Public investment in integrated ticketing for public transport and cycling is viewed as likely to make as much difference to respondents' lives as the development of more fuel efficient conventional vehicles.	Indicates support for policy that is inclusive rather than exclusive of options, supporting vision building and culture change at strategic level of TM. Perhaps offers an entry point for reducing the population's general pro-car attitudinal disposition.
Although anthropogenic climate change is accepted by the large majority (74%), 15% think that climate change is not due to human activity; another 4% think there is no climatic change; and 7% don't know.	For a quarter of the population, anthropogenic climate change may not be a convincing policy justification, causing continuing difficulty in gaining legitimacy for problem structuring at the strategic level of TM.
Group and population differences	
Geography	
Higher car use and lower public transport use in the Oulu region; stronger environmental concern in the Helsinki region.	Geography is significant, reflected both in transport practices and environmental concerns. This is likely to affect perceptions of policy legitimacy and underlines the importance of geography in TM efforts.

continued

Table 8.1 Continued

Survey result	*Issues and implications*
Non-winter frequency of bicycle use is highest in Oulu, then Tampere and lowest in Helsinki. But fewer people walk daily in Oulu.	Transport practices may reflect the availability of public transport infrastructure, particularly the tram, bus and metro system available in Helsinki, but also longer commuting distances in the Helsinki region. This underlines the context-specificity of the operational level of TM.
On perception of climate change, while the median for all three regions is similar, Oulu and Tampere have similar upper quartiles of respondents who believe that "the world's climate is changing, but human activity has no effect on it during this century".	As above, possibly more so outside of Helsinki.
On the bio-economy for transport, there were significant regional differences for all but one question. Helsinki respondents are sceptical of the sustainability of current forest utilisation, while Oulu is significantly more supportive of using more of the national timber stock for biofuel.	As above, this raises issues of centre–periphery differences that merit further investigation. Also, the region surrounding Oulu is more rural than in Helsinki and Tampere, perhaps indicating a closer economic link to the use of bio-resources. Region-specific design of public engagement processes and experiments linked to TM may (but equally may not) facilitate perceived policy legitimacy.
Gender Significantly more men than women say that they own a car, but gender distributions of having a permanent right to use a car do not differ. However, men make disproportionate use of car travel.	May indicate differing ownership attitudes and hence support for policy affecting car use. This links to the pro-car attitudes that TM must deal with in the transition to other transport modes.
Men are more climate-sceptic, being doubtful about either the effects or actuality of anthropogenic climate change. Fewer men than women strongly agree that car use has a serious effect on climate change and fewer men strongly agree that traffic congestion in towns and cities is a very serious problem.	May affect policy legitimacy and likely to affect male response to climate messaging.

Women are significantly more likely to register "Don't know" as a response to whether the State should prioritise biofuel research above other transport technology options, and to related questions on the use of timber for biofuel production.	Policy legitimacy requires improved communication and information provision (note that this may or may not enhance public policy support).
Age	
The youngest and oldest groups cycle most; the youngest group (15–24) walks the most.	Likely in part to reflect differential access to vehicles; differing practices have implications for the distribution of policy impacts and legitimacy. Yet the relevance of age and life stage is rarely discussed in TM contexts.
The youngest group (15–24) are most averse to prioritising biofuel research above other transport policy and technology options.	As above.
Income	
There are significant income-based differences for "I own a car", "My family has a car" and "I have permanent right to the use of a car". In all cases the differences are particularly between the highest and the lowest income groups.	As under "Age" above. Note that the low and high income brackets are, respectively, 20–35 k and 45 k+ euro. In other words, the difference is barely a factor of two. Yet the relevance of income differentials is rarely discussed in TM contexts.
Median car usage increases with income, more so for non-winter use. People in lower income brackets are more frequent users of public transport.	As above.
People in the lower income brackets agree more strongly with the proposition that the current level of car use has a serious effect on climate change and on traffic congestion.	As above, and also implies the possibility of a link between transport practice and environmental attitude. Likely to also reflect age associations.

Source: Upham *et al.* 2015.

Notes
The 1,000 person sample is significantly older, contains more retirees, fewer students and is better educated than the census population ($p < 0.05$). As is common, this has been corrected with weighting factors. All results reported are statistically significant between $p < 0.001$ and $p < 0.05$. Different types of statistical test were used as appropriate. More details on the tests and significance levels can be found in Upham *et al.* 2015.

Judging by the results of the survey, in future policy Finnish State support for mobility service innovation generally is likely to be viewed as legitimate, but these policies should include 'soft' as well as 'hard' forms of mobility innovation (as referred to in Note 3, below). Figure 8.2 illustrates how respondents ranked transport innovations in terms of what would make the most positive difference to their lives. The survey found that there is majority support for relatively familiar options in two almost equal groups; one for car based solutions (fuel efficiency, smart traffic lights, hybrid vehicles), and the other for public transport (integrated public transport ticketing, light rail).

Given the heterogeneity in opinion – the existence of majority views notwithstanding – governments face a complicated task in communicating with their electorates so as to create policy legitimacy and build support. This can be seen with the notional example of biofuel-related messaging, in the sense of communicating biofuel policy. Similar issues can be expected to arise with other pro-environmental policy messaging where support is mixed among electorates, be this differentiation along the lines

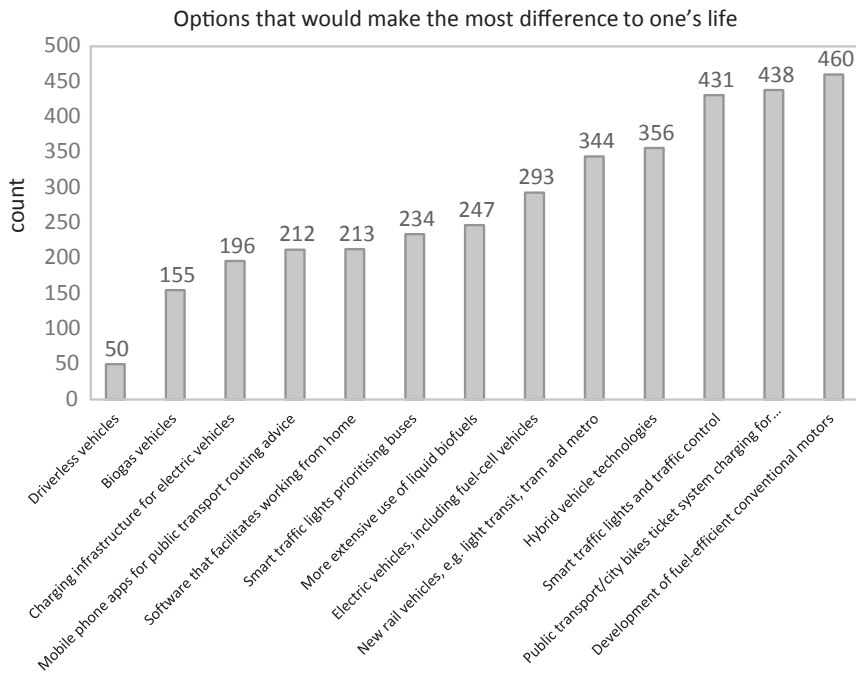

Figure 8.2 Respondents' ranking of which innovations would make the most difference to their lives.

Note
This is a response to the question: "Thinking about the options listed in Question 8, which do you think would make the most difference (positive) to your own life? Please indicate the five options that you think would make the most difference."

of age, gender, geography, social class or other dimensions. In relative terms, pro-biofuel policy related messaging can be expected to align more positively with the economic or livelihood interests of Oulu inhabitants than with those in Helsinki. General opinion towards biofuel innovation in the Helsinki region is more sceptical, particularly among the young.

As suggested above, gender opinion differences also arguably require modified modes and content of communication. Overall, women show less climate scepticism, and they perceive urban traffic congestion to be a more serious problem than men do. However, women are also more uncertain about the relative merits of different technological options for facilitating change (Upham *et al.* 2015). This implies that public information provision *may* have a greater (and perhaps positive) effect on women. While women, young, elderly and less affluent people already use low carbon transport options (i.e. public transport, cycling and walking) most frequently (all differences significant in the $p = 0.000$ to 0.003 range), among the population as a whole (as sampled), majority support is for relatively incremental innovations relating to the private car.

In the transport sector, it is implausible that the existing and emergent low carbon technological options can be deployed in time and at a sufficient scale to meet stringent decarbonisation targets (Hoen *et al.* 2009). Despite higher male support for private car innovations, there is a case for prioritising policies that strengthen the *existing* low carbon forms of transport provision. This would not exclude support for private car innovation, but it would take into account the possibilities that the demographic and geographic differences offer, and it would respond to the constrained timescale for introducing new technologies. Such an approach would also acknowledge existing path dependencies, particularly those associated with the private car (Banister *et al.* 2011; Upham *et al.* 2013). In the terminology of the MLP, low carbon technological developments associated with the private car have only recently begun to move beyond the niche level (apart from first generation biofuels). While regional variation in public opinion will complicate TM efforts at the national level, simply moving the incremental innovations beyond the niche would represent major achievements per se (Upham *et al.* 2015).

Implications: the politics of transitions management

It is clear that, compared to the generally implicit politics of innovation studies, TM has an explicit normative and political dimension, seeking as it does to support the steering of sociotechnical change in more 'sustainable' directions. While TM may have some of its roots in systems analysis, it is far from wholly analytic.

TM theory focuses on the means and modes of changing structures, cultures and practices in particular functional sectors (Frantzeskaki and de Haan 2009), transport (or mobility) being just one. Building new networks

and experimenting with initiatives outside of formal institutions are commonly advocated as a means of leveraging forces operating at the niche, regime and landscape levels (Geels and Schot 2007) in mutually reinforcing directions. While until now 'publics' have not figured strongly in such analysis, the connectedness of contemporary information and communication technologies have already empowered citizens and citizen-consumers seeking change (Scammell 2000). Similarly, citizen and stakeholder consultations on new policies by public authorities, as well as topic-based polling undertaken for interest groups and others, is already common practice. What is less commonly practised, however, are more formalised ways of using consultation and poll results in policy-making and, indeed, in explicit connection with TM.

Where TM theorists have advocated learning experiments and broader network formation outside of formal institutions, they have done so primarily in recognition of the role of new networks in generating ideas, agendas and generally supporting change (Loorbach and Rotmans 2010), rather than for any normative or principled commitment to participatory democracy. In general, TM experiments seem to involve a relatively small number of selected change agents and stakeholders (e.g. Nevens *et al.* 2013; Nevens and Roorda 2014), rather than the public or publics at large. Moreover, without some deliberate policy on how the issue of democratic representativeness is to be tackled in TM, the approach is open in practice to the critique of commercial bias or capture (Hendriks 2008, 2009).

Thus, there is both a normative and a theoretical case for more explicit and systematic public engagement in TM processes, while also acknowledging that this raises difficult questions regarding how to structure engagement and consultation processes. Just as Coenen *et al.* (2012) emphasise the need to attend to geography in the context of production networks, so this is equally relevant in the context of TM and the role of public opinion in TM processes. In this regard, we would suggest that the critical and applied environmental planning literatures on infrastructure-siting controversies have much to offer by way of understanding, perspectives and practical advice. These literatures emphasise the roles of governance, institutional trust, perceived equity and place attachment (e.g. Upham and Shackley 2006; Devine-Wright 2008), all of which have strong local dimensions. Indeed, objections to technological innovations often do play out at the implementation stage, and often such opposition is local at its core.

Conclusion

TM advocates knowledge generation among actors from multiple sectors, and is intended to further sustainability norms. It aims to increase both the types and breadth of knowledge that is taken into account in policy related decision-making, and also to increase the range of actors involved

(Valkenburg and Cotella 2016). TM arenas are seen as particularly relevant and necessary in the context of problems of high uncertainty and normative ambiguity (ibid.), where existing policy design seems to fall short of effecting change at the pace required (or perceived to be required).

In this chapter, we have highlighted the merits of public input to sociotechnical innovation policy and to policies relevant for sociotechnical transitions more generally. We have observed that this is in any case implied in the socially directive nature of TM. Moreover, we have suggested that public engagement is desirable for reasons of policy legitimacy in the process of advancing sustainability transitions. Yet, the public or publics rarely figure as central actors in the sociotechnical transitions literature, and this despite their critical roles in legitimising and/or frustrating policy, supporting the NGOs that amplify and intermediate public opinion and as consumers whose billions of annual purchases make or break companies and drive economic trends.

Here, we have particularly focused on the potential policy legitimation role of publics, rather than their (our!) role as consumers, illustrating how public opinion, both in aggregate and as differentiated by demography and geography, has implications for policy legitimacy. Conceptually, we set this in the context of implications for public engagement in TM in general, drawing on the science and technology studies literature for its longstanding contribution in this regard. In so doing, we have also aimed to contribute to the transitions sub-literature that seeks to re-embed conceptualisations of transitions in their geographical contexts.

The observed heterogeneity of – and geographical variation in – public opinion, as well as the path dependencies linked to existing sociotechnical systems, pose challenges for societal transformative change. This heterogeneity among national, local and other publics also implies that in TM more attention needs to be given to geography and to specific local contexts from the outset. In this respect, surveys may be used as an indicative tool in assessing public opinion-related issues (including the likelihood of success) relating to niche experiments in particular regions. Seeking to account for public opinion as part of technology governance processes poses some fundamental (and, frankly, difficult) challenges, but public opinion matters crucially for pathways of sociotechnical change. Seeking congruence between public opinion, policy design and policy direction should help to legitimate the policy support that new technologies and social innovations need in order to compete with the current path-dependent systems.

Building meaningful public consultation into policy processes poses considerable challenges (Pidgeon *et al*. 2014), particularly given the restrictive time frames implied by stringent climate targets. Nonetheless, the results of public opinion vis-à-vis specific or more systemic sociotechnical innovations, which may include levels and types of project opposition or support, has the potential to strengthen or weaken stresses that are internal

or external to the existing regime. Such public opinion many also constitute important elements of those stresses themselves. This, in turn, has implications for the transition processes of niche empowerment, reconstellation and adaptation that are required as the regime components realign to form a new regime configuration. Thus, we argue that sociotechnical transitions theorists and practitioners *need* to pay more attention to public opinion – and to the potential formative power therein – if they are to successfully catalyse new and durable policy directions for the future transitions of energy systems.

Notes

1 Source: ScienceDirect database, searched with 'transition management' in the title, abstract or keywords; English language only (date of search 17 August 2018).
2 This raises the issue of how the political and policy sciences conceive of change and the role of the public or publics therein. For an overview of the implications of five key theories of policy change for transitions processes, see Kern and Rogge (2018). It is notable, though, that none of these highlight processes of mobilisation of public opinion. The five theories are: Sabatier's advocacy coalition framework; Kingdon's multiple streams approach; Baumgartner's punctuated equilibrium theory; Hajer's discourse coalitions framework; and Pierson's policy feedback approach (ibid.).
3 Twelve different types of technology response options were offered, spanning private and public transport as well as options intended to reduce the need for transport. Broadly two thirds of people supported publicly funded research, development and deployment (RD&D) for technologies relating to new propulsion systems and fuels (fuel-efficient conventional vehicles; more extensive use of liquid biofuels; hybrid vehicle technologies; electric, biogas and fuel-cell vehicles; charging infrastructure for electric vehicles; and light rail). This level of support also extended to: integrated ticketing systems that span public transport types and bicycle carriage; telecommunications systems that facilitate home-working and public transport use; and smart traffic lights. However, only about 30 per cent of people supported public RD&D for autonomous (driverless) vehicles.
4 Nearly 74 per cent of the total sample agreed that "the world's climate is changing due to human activity this century". About 15 per cent agreed that the climate is changing but not due to human activity, some 4 per cent considered there to be no climatic change and 7 per cent did not know. Kruskal-Wallis tests with post hoc pairwise comparisons were used to compare regions and genders. Only statistically significant results are reported here.

Bibliography

Avelino, F. and Rotmans, J. 2009. "Power in transition: An interdisciplinary framework to study power in relation to structural change". *European Journal of Social Theory* 12:543–69.

Avelino, F. and Wittmayer, J. M. 2016. "Shifting power relations in sustainability transitions: A multi-actor perspective". *Journal of Environmental Policy & Planning* 18:628–49.

Banister, D. 2008. "The sustainable mobility paradigm". *Transport Policy* 15:73–80.

Banister, D., Anderton, K., Bonilla, D., Givoni M. and Schwanen T. 2011. "Transportation and the environment". *Annual Review of Environment and Resources* 36:247–70.

Barker, R. 1990. *Political Legitimacy and the State*. Oxford: Clarendon Press.

Coenen, L., Benneworth, P. and Truffer, B. 2012. "Toward a spatial perspective on sustainability transitions". *Research Policy* 41(6):968–79.

de Haan, J. and Rotmans, J. 2011. "Patterns in transitions: Understanding complex chains of change". *Technological Forecasting and Social Change* 78(1):90–102.

Delgado, A., Kjølberg, K. L. and Wickson F. 2011. "Public engagement coming of age: From theory to practice in STS encounters with nanotechnology". *Public Understanding of Science* 20(6):826–45.

Devine-Wright, P. 2008. "Reconsidering public acceptance of renewable energy technologies: A critical review". In: M. Grubb, T. Jamasb and M. G. Pollitt (eds.), *Delivering a Low Carbon Electricity System: Technologies, Economics and Policy*. Cambridge: Cambridge University Press.

EC. 2011. "Future of transport: Analytical report". Flash Eurobarometer, Directorate General for Communication, European Commission and The Gallup Organization, Brussels. Available at: http://ec.europa.eu/public_opinion/flash/fl_312_en.pdf [accessed 13 January 2015].

European Climate Foundation. 2013. "Fuelling Europe's future: How auto innovation leads to EU jobs". European Climate Foundation, Brussels. Available at: https://issuu.com/fam.robertbleeker/docs/fuelling_europe_s_future-_how_auto_ [accessed 30 November 2018].

Frantzeskaki, N. and de Haan, H. 2009. "Transitions: Two steps from theory to policy". *Futures* 41:593–606.

Frantzeskaki, N., Loorbach, D. and Meadowcroft, J. 2012. "Governing societal transitions to sustainability". *International Journal of Sustainable Development* 15(1):19–36.

Geels, F. W. 2012. "A socio-technical analysis of low-carbon transitions: Introducing the multi-level perspective into transport studies". *Journal of Transport Geography* 24:471–82. doi:10.1016/j.jtrangeo.2012.01.021.

Geels, F. W. and Schot, J. 2007. "Typology of sociotechnical transition pathways". *Research Policy* 36:399–417. doi:10.1016/j.respol.2007.01.003.

Geels, F. W. and Schot, J. 2010. "The dynamics of socio-technical transitions: A socio-technical perspective". In: J. Grin, J. Rotmans and J. Schot (eds.), *Transitions to Sustainable Development: New Directions in the Study of Long Term Transformative Change*. New York: Routledge, pp. 30–101.

Goodwin, P. and Lyons, G. 2010. "Public attitudes to transport: Interpreting the evidence". *Transportation Planning and Technology* 33(1):3–17.

Hendriks, C. M. 2008. "On inclusion and network governance: The democratic disconnect of Dutch energy transitions". *Public Administration* 86(4):1009–31.

Hendriks, C. 2009. "Policy design without democracy? Making democratic sense of transition management". *Policy Sciences* 42(4):341–68.

Hoen, A. Geurs, K., de Wilde, H., Hanschke, C. and Uyterlinde, M. 2009. "CO_2 emission reduction in transport: Confronting medium-term and long-term options for achieving climate targets in the Netherlands". Netherlands Environmental Assessment Agency and Energy Research Centre of the Netherlands,

Bilthoven and The Hague. Available at: www.rivm.nl/bibliotheek/rapporten/500076009.pdf [accessed 13 January 2015].

Kemp, R., Loorbach, D. and Rotmans, J. 2007. "Transition management as a model for managing processes of co-evolution towards sustainable development". *International Journal of Sustainable Development & World Ecology* 14(1):78–91. doi:10.1080/13504500709469709.

Kern, F. and Rogge, K. S. 2018. "Harnessing theories of the policy process for analysing the politics of sustainability transitions: A critical survey". *Environmental Innovation and Societal Transitions* 27:102–17.

Loorbach, D. 2009. "Transition management for sustainable development: A prescriptive, complexity-based governance framework". *Governance* 23:161–83. doi:10.1111/j.1468-0491.2009.01471.x.

Loorbach, D. and Rotmans, J. 2010. "The practice of transition management: Examples and lessons from four distinct cases". *Futures* 42(3):237–46.

McKinsey & Company. 2009. "Roads toward a low carbon future: Reducing CO_2 emissions from passenger vehicles in the global road transportation system". McKinsey & Company, New York. Available at: www.mckinsey.com/~/media/McKinsey/dotcom/client_service/Sustainability/PDFs/roads_toward_low_carbon_future_new.ashx [accessed 30 November 2018].

Macnaghten, P. and Chilvers, J. 2014. "The future of science governance: Publics, policies, practices". *Environment and Planning C: Politics and Space* 32(3):530–48.

Markard, J., Raven, R. and Truffer, B. 2012. "Sustainability transitions: An emerging field of research and its prospects". *Research Policy* 41:955–67.

Nahuis, R. and van Lente, H. 2008. "Where are the politics? Perspectives on democracy and technology. *Science, Technology, & Human Values* 33(5):559–81.

Nevens, F. and Roorda, C. 2014. "A climate of change: A transition approach for climate neutrality in the city of Ghent (Belgium)". *Sustainable Cities and Society* 10:112–21.

Nevens, F., Frantzeskaki, N., Gorissen, L. and Loorbach, D. 2013. "Urban transition labs: Co-creating transformative action for sustainable cities". *Journal of Cleaner Production* 50:111–22.

PE International. 2013. "Life cycle CO_2e assessment of low carbon cars 2020–2030". Low Carbon Vehicle Partnership, London. Available at: www.lowcvp.org.uk/lowcvp-viewpoint/reports.asp [accessed 30 July 2013].

Pidgeon, N., Demski, C., Butler, C., Parkhill, K. and Spence, A. 2014. "Creating a national citizen engagement process for energy policy". *Proceedings of the National Academy of Sciences* 111(Suppl 4):13606–13.

Raven, R. P. J. M., Schot, J. W. and Berkhout, F. 2012. "Space and scale in socio-technical transitions". *Environmental Innovation and Societal Transitions* 4:63–78.

Rip, A. and Kemp, R. 1998. "Technological change". In: S. Rayner and E. Malone (eds.), *Human Choice & Climate Change*, *Volume 2: Resources and Technology*. Columbus, OH: Battelle Press.

Rotmans, J., Kemp, R. and Asselt, M. V. 2001. "More evolution than revolution: Transition management in public policy". *Foresight* 3(1):15–31.

Rowe, G. and Frewer, L. J. 2000. "Public participation methods: A framework for evaluation". *Science, Technology, & Human Values* 25(1):3–29.

Scammell, M. 2000. "The internet and civic engagement: The age of the citizen-consumer". *Political Communication* 17(4):351–5.

Sclove, R. E. 1995. *Democracy and Technology*. New York: The Guilford Press.
Suchman, M. C. 1995. "Managing legitimacy: Strategic and institutional approaches". *The Academy of Management Review* 20(3):571–610.
Temmes, A., Virkamäki, V., Kivimaa, P., Upham, P., Hildén, M. and Lovio, R. 2014. "Innovation policy options for sustainability transitions in Finnish transport". Tekes, Helsinki. Available at: www.researchgate.net/publication/266971688_Innovation_policy_options_for_sustainability_transitions_in_Finnish_transport.
Upham, P. and Dendler, L. 2014. "Scientists as policy actors: A study of the language of biofuel research". *Environmental Science and Policy* 47:137–47.
Upham, P. and Shackley, S. 2006. "The case of a proposed 21.5 MWe biomass gasifier in Winkleigh, Devon: Implications for governance of renewable energy planning". *Energy Policy* 34:2161–72.
Upham, P., Kivimaa, P. and Virkamäki, V. 2013. "Path dependence and expectations in transport innovation policy: The case of Finland and the UK". *Journal of Transport Geography* 32:12–22.
Upham, P., Virkamäki, V., Kivimaa, P., Hildén, M. and Wadud, Z. 2015. "Sociotechnical transitions governance and public opinion: The case of passenger transport in Finland". *Journal of Transport Geography* 46:210–19. doi:10.1016/j.jtrangeo.2015.06.024.
Valkenburg, G. and Cotella, G. 2016. "Governance of energy transitions: About inclusion and closure in complex sociotechnical problems". *Energy, Sustainability and Society* 6:20. doi:10.1186/s13705-016-0086-8.
VTPI. 2010. *Online Transport Demand Management Encyclopedia*, Victoria Transport Policy Institute, BC. Available at: www.vtpi.org/tdm/ [accessed 10 December 2018].
VTT. 2012. *Low Carbon Finland 2050* [online], VTT, Helsinki. Available at: www.vtt.fi/sites/lowcfin/en/low-carbon-finland-2050 [accessed 10 December 2018].
Wellman, B. 1978. "Public participation in transportation planning". *Traffic Quarterly* 31(4):639–56.
Wynne B. 1973. "At the limits of assessment". In: G. J. Stober and D. Schumacher (eds.), *Technology Assessment and Quality of Life*. Amsterdam: Elsevier Scientific Publishing.