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Sustainable transport visions: expert and non-expert stakeholder perspectives on sustainable transport

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ABSTRACT

Transport systems perform vital societal functions, but in their present state cannot be considered 'sustainable'. Particular concerns in this respect include emissions, accidents, land use, noise and social exclusion. Sustainability is a complex and contested notion; consequently, sustainability assessment involves drawing on diverse stakeholder perspectives and societal values as well as on scientific evidence. In this paper, we report on participatory research conducted within the MATISSE project to assess sustainable transport, drawing on findings from expert and non-expert stakeholder workshops and questionnaires to elucidate criteria and options for sustainable transport. Our findings indicate different stakeholder groups agree on the need to address problems of unsustainability in the transport sector, and identify broadly similar environmental, social and economic criteria for sustainable transport. Non-experts focussed less on technical solutions, and highlighted more institutional and cultural barriers to sustainable transport, than did expert participants. However, we argue that there are important limitations to the categories of 'expert' and 'non-expert' and argue for more inclusive processes of knowledge production and policy assessment. Overall, our research indicates a need for integrated policy approaches to tackle unsustainable transport by addressing the socio-cultural and structural determinants of transport demand, as well as by offering technological solutions. Pathways to sustainable transport with both technological and behavioural elements are necessary.

Key words: Transport, Sustainability, Stakeholder perspectives, Assessment

1 INTRODUCTION

In this paper, we present findings from recent stakeholder work conducted within the EU Framework Six MATISSE project[1], to elucidate criteria for sustainable transport and assess the potential for different pathways and policies to meet these criteria. In section 2, evidence for the unsustainability of the transport system and policy initiatives for sustainable transport are reviewed. Section 3 outlines the methodology; and section 4 reports the results of recent work conducted within the MATISSE project to elicit expert and non-expert stakeholders' visions of sustainable transport and their perspectives on different technological and policy options for sustainable transport. In section 5, we conclude by outlining the implications for policy-making in respect of transport technologies and behaviour-change policies; and reconsider the value that stakeholder perspectives hold in assessing these issues.

2 UNSUSTAINABLE TRANSPORT AND OPTIONS FOR ACHIEVING SUSTAINABILITY

2.1 The unsustainability of today's transport system

Transport is crucial for our economic competitiveness and commercial, economic and cultural exchanges. This sector of the economy accounts for some 1,000 billion Euro, or over 10% of the EU's gross domestic product, and employs 10 million people. Transport also helps to bring Europe's citizens closer together, and the Common Transport Policy is one of the cornerstones of European development and integration (European Commission, 2001a).

However the current transport system does not correspond to the requirements of sustainability in many respects. Health and environmental impacts of road transport are particular concerns. In respect of climate change, transport is the sector with the highest increase of greenhouse gas emissions in recent decades, rising by 24% between 1990 and 2003 (European Environment Agency, 2005). Local air pollution and noise associated with transport are problems for the increasing proportion (80%) of the European population living in urban areas. In respect of health[2], particulate emissions and ozone are the main problems, contributing to around 370,000 premature deaths in Europe each year (European Environment Agency, 2006). Up

[1] Methods and Tools for Integrated Sustainability Assessment (MATISSE). See: www.matisse-project.net

[2] Increasing dependence on car use has also been linked to rises in obesity in western societies (Cohen, 2005).

to 80 million Europeans suffer from unacceptable levels of noise, much of which is caused by traffic-related sound. This can lead to hypertension, myocardial infarction or sleep disturbance (European Union Road Federation, 2004). Road transport also presents other risks to human health and safety. Although fatality rates have decreased, road accidents still claim 41,000 lives per year in the EU (European Environment Agency, 2001). Congestion and land use associated with transport infrastructure are also problems for most European countries (INFRAS, 2004). Furthermore, transport infrastructure is both costly to maintain and takes up increasing amounts of rural and urban land, leaving less space for other human needs such as housing, services and recreation, and threatening biodiversity (European Commission, 2001b; 2005). Other impacts associated with transport infrastructure include soil sealing and fragmentation of natural, semi-natural and agricultural areas (European Commission, 2001b).

There are also several notable social problems associated with transport. One major element for a sustainable transport system is access to basic services such as shopping, work and education (SUMMA, 2005). In some countries, people have to travel increasing distances to gain this access due to changing spatial patterns (e.g., urban sprawl and development of out-of-town centres). Furthermore, due to increasing fuel prices, limited reserves of oil and gas, as well as increased spread of incomes in EU countries, the issue of wide access to affordable transport in the EU could become an increasingly relevant issue in the future. The issue of access and social inclusion particularly affects rural communities and groups with impaired mobility, such as the elderly and disabled (Guide Dogs, 2004). As European populations age, this problem is likely to be exacerbated.

Additionally, transport is a major driver of energy use. It accounts for more than one quarter of the world's and 32% of the EU's commercial energy use, and these proportions are increasing. The transport market is today almost entirely dependent upon oil-based fuels and is responsible for about 67% of final oil demand in the EU (European Environment Agency, 2005). Therefore energy supply security and resource use are two critical topics for today's transport system.

2.2 Defining and achieving sustainable transport

Although the notion of 'sustainability' is contested and different criteria are emphasised by different groups (European Commission, 2001a, 2006; Joint Expert Group on Transport and Environment, 2000; SUMMA, 2005; Whitmarsh & Wietschel, 2006), broadly speaking sustainable mobility is understood to contribute to social and economic welfare, without damaging the environment or depleting environmental resources. For example, the World Business Council for Sustainable Development defines 'sustainable mobility' as 'the ability to meet the needs of society to move freely, gain access, communicate, trade, and establish relationships without sacrificing other essential human or ecological values today or in the future' World Business Council on Sustainable Development, 2004. The various dimensions of 'sustainable mobility' may be grouped under social, economic and environmental pillars of sustainability (see Table 1).

Table 1. Dimensions of sustainable mobility (SUMMA, 2005)

Economic outcomes	**Environmental outcomes**	**Social outcomes**
Accessibility	Resource use	Accessibility and affordability
Transport operation cost	Direct ecological intrusion	Safety and security
Productivity/ efficiency	Emissions to air	Fitness and health
Costs to economy	Emissions to soil and water	Liveability and amenity
Benefits to economy	Noise	Equity
	Waste	Social cohesion
		Working conditions in transport sector

Because of the importance of transport to economies, EU policy has historically focussed on liberalisation and harmonisation of transport to form a single trans-European transport network. More recently it has incorporated sustainability considerations into transport policies. Mobility is one of the six priority areas of the EU's Sustainable Development Strategy (European Commission, 2001b). Furthermore, the European Commission's (2001a) *White Paper on the future Common Transport Policy* highlights a range of initiatives necessary for tackling problems of sustainability in the transport sector, including fostering modal shift towards environmentally friendly modes (rail, inland waterways, short sea shipping); promoting alternative vehicle and fuel technologies; improving efficiency; and internalising environmental costs in transport prices.

However, measures taken so far to influence individual travel decisions have had little effect relative to the underlying growth in demand. Indeed, in some cases, interventions to reduce demand or foster modal shift have had the reverse effect (Goodwin, Cairns, Dargay, Hanly, Parkhurst, Stokes, & Vythoulkas, 2004). Similarly, the benefit of technical measures to reduce vehicle emissions and noise has often been outstripped by the increase in vehicle numbers, engine size, travel frequency and trip length (European Commission, 2001b). The rising demand for transport, particularly road transport, suggests a need for radical rather than incremental technological improvements as well as integrated approaches to reducing demand and encouraging modal shift.

2.3 Stakeholder involvement in sustainability assessments

Stakeholder engagement is relevant to this issue given the complexity, ambiguity and subjectivity that surround persistent problems of unsustainability, such as transport. The MATISSE project, in which this transport case study is situated, is developing and testing approaches to Integrated Sustainability Assessment (ISA), which has been defined as a fundamentally participatory approach to sustainability assessment (Weaver & Rotmans, 2005; cf. Gibson, Hassan, Holtz, Tansey, & Whitelaw, 2005). This is consistent with the notion of post-normal or 'Mode 2' science, which is more inter-disciplinary, socially-accountable and applied than traditional scientific models of knowledge production (Gibbons, Limoges, Nowotny, Schwartzman, Scott, & Trow, 1994).

Three main arguments may be posited for the value of stakeholder participation in sustainability research and assessment: normative, substantive and instrumental (Fiorino, 1990). Firstly, sustainability involves subjective judgements about what future we should have and would like to have. While scientific research plays an important role in defining environmental, social and economic impacts of transport options, decisions about the acceptability of these impacts, and any trade-offs between different sustainability criteria, are based on social values and personal preferences. Secondly, sustainability issues are interdisciplinary and complex, and their assessment demands the expertise and unique experiences of a range of stakeholders (Newig, Pahl-Wostl, & Sigel, 2004). Drawing on this diverse knowledge improves the quality of decision-making and produces socially robust science. Thirdly, participatory assessment can foster trust and learning. By involving stakeholders in policy-relevant research, they will be more likely to feel ownership of the knowledge-making process and to be prepared to cooperate. Furthermore, stakeholder engagement processes can reduce conflict and build trust between stakeholders, by providing an opportunity to learn about other perspectives, values and knowledge (Haste, 2005). In this sense, the process itself - as well as the substantive outcomes - can be beneficial. Involving stakeholders will not necessarily result in a more sustainable solution; consequently, participation should not be seen as a panacea. However, considering diverse perspectives is likely to improve the validity and applicability of assessment (Gibson et al., 2005).

2.4 Stakeholder perspectives on sustainable transport

Stakeholder perspectives on transport technologies and policies have been elicited in several previous studies (e.g., Bristow, Pridmore, Tight, May, Berkhout, & Harris, 2004; Jeon & Amekudzi, 2005; O'Garra, Mourato, & Pearson, 2005; Office of Science and Technology, 2005; Sayer, 2003). This research tends to elicit expert stakeholder opinion and highlights a need for both technological and non-technological measures to tackle rising transport demand.

Research into public attitudes to transport and transport policy highlights significant challenges to introducing demand management policies. While the UK public expresses concern about pollution and congestion levels (Lethbridge, 2001) and acknowledges the link between transport and climate change (DEFRA, 2002; Department for Transport, 2007), there is growing resistance to measures to curb car use (e.g., raising road or fuel taxes) (Lethbridge, 2001). This highlights the widespread association between driving on one hand, and quality of life, status and identify on the other (Lorenzoni, Nicholson-Cole, & Whitmarsh, in press; Steg, Vlek, & Slotegraaf, 2001).

Both expert and public perspectives on transport have typically been elicited through conventional survey or interview approaches. While these provide valuable insights into the likely effectiveness and acceptability of transport policies, they do not allow for exploration of the inconsistencies and trade-offs associated with transport. For example, these surveys highlight the apparent contradiction between public acceptance and experience of problems with road transport on one hand and their unwillingness to change their behaviour on the other. Here, qualitative methods afford us insights into the deeper institutional and social aspects of such sustainability dilemmas (Lorenzoni et al., in press). Furthermore, the little research that has been conducted to elicit the views of the non-expert public on novel transport technologies such as hydrogen and fuel cell vehicles suggests only a small minority know anything about these technologies (O'Garra et al., 2005). This highlights a need to provide deliberative fora in which non-experts can learn about and interact with scientific and technical information about emerging technologies and proposed policies. The research reported here thus applies deliberative methods to sustainable transport assessment in order to create a more meaningful role for non-experts and a method for understanding discourses and institutional dimensions of citizen-transport system interactions.

The research described here builds on and extends this previous work on stakeholder perspectives of sustainable transport futures. However, in contrast to this earlier work, the aim of the MATISSE research is to elicit both expert and non-expert stakeholder perspectives about sustainable transport futures and pathways, and to identify where these groups hold similar and divergent views. The aim of this strategy is not only to provide a robust assessment of sustainable transport, but also to inform debates about participatory processes of governance and assessment. In this sense, our study employs a more integrative and reflexive focus than in previous studies on transport futures, by assessing the potential for different transport technologies and policies to meet society’s needs and preferences for transportation.

3 METHODOLOGY

3.1 Expert focus groups and questionnaires

As part of a cluster workshop on sustainability of hydrogen transport technologies held in Frankfurt during February 2006, MATISSE researchers conducted focus groups with, and distributed self-completion questionnaires to, stakeholders with interests and expertise in sustainable transport and hydrogen transport technology. The aims of the focus groups and questionnaires were to elicit stakeholders' visions of sustainability in relation to both transport in general and hydrogen transport technology in particular; and their views on viable pathways, and any barriers, to sustainable hydrogen-based transport. This paper focuses on findings relating to sustainable transport in general; participants' views on hydrogen technologies are reported elsewhere (Whitmarsh & Wietschel, 2006).

Participants at the cluster workshop included researchers and consultants, an NGO representative, policy-makers, and members of the automotive and energy industries from across Europe, with interests and expertise in hydrogen and transport technologies (see Figure 1). While this does not represent a comprehensive range of transport stakeholders, it includes key decision-makers in hydrogen technologies and sustainable transport (Whitmarsh & Wietschel, 2006). Furthermore, most of the participants can be considered *experts* in hydrogen technologies and sustainable transport, with researchers constituting the largest proportion of participants. Further research will be conducted to elicit the views of expert stakeholder groups not represented at the workshop.

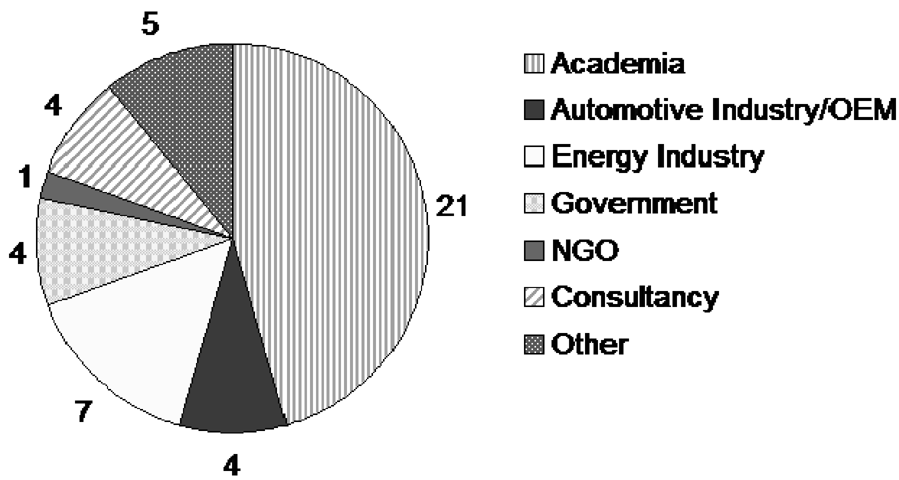

Figure 1. Background of expert participants

All workshop participants were assigned to one of five focus groups according to the stakeholder ‘category’ they represented (i.e. Automotive Industry, Energy Industry, Research/ Academia, Consultancy, NGO, and Policy/ Government). The composition of the break-out groups was designated in advance of the workshop. The break-out groups comprised both heterogeneous and homogeneous categories of stakeholders:

- Group 1 was a homogeneous group of 10 Research stakeholders only (4 women, 6 men)
- Group 2 was a heterogeneous group comprising 3 Research, 1 Consultancy, 1 Policy, 1 NGO, 3 Energy Industry, and 1 Automotive Industry stakeholders (2 women, 10 men)
- Group 3 was a heterogeneous group comprising 2 Research, 4 Consultancy, 2 Policy-Makers, 1 Automotive Industry, and 1 Energy Industry stakeholders (1 woman, 9 men)
- Group 4 was a heterogeneous group comprising 2 Automotive Industry, 1 Energy Industry, and 3 Research stakeholders (6 men)
- Group 5 was a homogeneous group of Energy Industry stakeholders only (2 women, 4 men)

The rationale for using both homogeneous and heterogeneous groups was to enable a comparison of group dynamics and social learning amongst similar and diverse stakeholder groups. Each group lasted around one hour and was facilitated by one or two facilitators from the MATISSE project team.

At the end of the break-out group discussion, participants were asked to fill in a self-completion questionnaire with more focussed questions that allowed respondents to express their opinions anonymously. All 44 questionnaires were returned completed. Excel and SPSS were used to produce descriptive statistics and graphs.

3.2 Citizen workshops and questionnaires

Two workshops were organised as part of two events to engage the public in science or environmental issues: the BA Festival of Science in September 2006, and the Norwich Forum Trust’s Earth Event in March 2007. A methodology similar to that developed by Kasemir et al. (Kasemir, Jaeger, & Jager, 2003) in the EU-funded ULYSSES project was used, in which spontaneous feelings and concerns are initially elicited via a ‘visioning exercise’, followed by expert input, followed by deliberation and elicitation of participants’ informed opinions. Each workshop lasted 2½ - 3 hours, with a short coffee break after around an hour. The aim of the workshops was both to elicit information about citizens’ perceptions and concerns, and to provide information about novel transport technologies and policies. In this sense, the workshops involved two-way exchanges of information, and were intended to result in mutual learning between citizens and researchers.

The initial *visioning exercise* comprised an individual exercise in which participants wrote about what they wanted the future of transport to be like in 2030, and then what they expected it to be like; prompts - including specific questions, images and newspaper headlines - were provided to help structure the exercise. Facilitated small-group discussion then followed, in which participants used the ideas they had generated in the individual exercise to answer two questions: *'What are the most important features you would like to see in Norfolk's transport system in the future?'* and *'Why are there differences between your ideal future and expected future?'*

Importantly, the workshops did not ask participants about what type of system they felt would be most 'sustainable', as this is not a term that the public is widely familiar with (Darnton, 2004) and may have led to citizens trying to second-guess objective/expert criteria. Rather, since we were interested in eliciting subjective experiences, views and concerns, we chose to use the terms 'most important', 'preferred' and 'ideal' instead of 'sustainable' (at least during the interactive stages). Nevertheless, as the report highlights, participants raised similar environmental, social and economic criteria for their preferred transport system as are commonly understood to characterise sustainable transport (e.g., European Commission, 2001a).

Brief, *expert presentations* provided accessible information about the problems of unsustainability in transport, and outlined the advantages and disadvantages of a range of technological and behavioural options for addressing these problems and potentially fostering more sustainable futures. Participants then asked the presenters questions about, and discussed their views on, these options in plenary. Finally, participants were asked to vote on their preferred option for sustainable transport (and to add any alternatives that had not already been mentioned, to the pre-defined list) by allotting ten 'sticky dots' amongst the options. They then completed a brief evaluation questionnaire, which also asked about participants' preferred criteria for future transport and their preferred option presented in the workshop.

Each workshop involved around 15 participants (in most cases, participants attended only one workshop, though a few came to more than one), most of whom lived in Norfolk. Participants were asked to book in advance (either via a designated website, or by telephone or email). Demographic information was obtained via self-completion questionnaires, completed by most participants at the end of each workshop. As shown in Table 2, participants included both men and women and a range of age groups, but were relatively well-qualified.

Table 2. Demographic background of citizen workshop participants

	September 2006	March 2007
Gender		
Male	7	5
Female	2	5
Not known	5	5
Age group		
Under 16	1	1
16-24	2	0
25-34	2	1
35-44	0	1
45-54	2	4
55-64	0	2
65-74	1	1
75 or above	1	0
Not known	5	5
Highest qualification		
No formal qualifications	0	0
GCSE / O-Level	0	1
A-level / Higher / BTEC	2	0
Vocational / NVQ	0	0
Degree or equivalent	1	3
Postgraduate qualification	5	4
Other	1	0
Not known	5	7
Membership of environmental organisation		
Yes	6	5
No	3	3
Not known	5	7
Nearest town/city		
Norwich	6	10
Norfolk (other)	1	0
Other	2	0
Not known	5	5

3.3 Advantages and limitations of the methods used

The rationale for using both group discussion and individual self-completion questionnaires is that there are advantages and limitations to each method. Qualitative discussion is appropriate for exploring the range of beliefs, ideas and behaviours that exist in relation to a particular issue, and the way in which the issue is framed in relation to more salient concerns or broader debates. However, in a group setting, social influences (e.g., different personality types, professional credibility and status), can determine and constrain participants' contributions, while also providing an insight into the dynamic construction of attitudes (Potter & Wetherell, 1987). Furthermore, qualitative methods are not able to indicate the prevalence of particular beliefs or actions, or allow for statistical comparison between groups. On the other hand, quantitative questionnaires allow researchers to ask more focussed questions about the issue, and determine the prevalence of particular views or concerns amongst the sample. Furthermore, there may be issues that respondents would prefer not to discuss in a group that can be expressed in an anonymous questionnaire. Combining these methods thus provides a complementary strategy for knowledge elicitation and social learning.

The citizen workshop design was intended to allow participants to 'observe' the process of knowledge elicitation/construction for themselves, with flipchart notes from the small group discussions stuck to the wall (and key points from these groups summarised by the lead facilitator); and the outcome of the voting exercise immediately visible. Participants were also asked in the evaluation questionnaire whether they would like to be sent results from the research. Providing feedback in this way is intended to highlight the value of participation and foster a sense of collaboration in the research.

A limitation of the current study relates to the representativeness of the stakeholder sample. As mentioned, the aim of the research was to elicit the views of expert and citizen stakeholders in transport. However, the expert participants were primarily *hydrogen* transport experts; and notable groups were excluded from the expert workshop, including public transport providers and biofuel producers. Furthermore, the citizen workshops, which 'piggy-backed' on broader programmes of public events in order to reduce costs (e.g., advertising, room hire), inevitably drew relatively educated and environmentally-aware participants (see below), and so do not necessarily represent the general Norfolk or UK populations. The findings discussed below should therefore be considered in light of these biases. To mitigate this limitation the view of stakeholders elicited in other hydrogen studies (mentioned in section 2.4), are also included in the following discussion where they deal with the same topics addressed in this study.

4 RESULTS: STAKEHOLDER VISIONS OF SUSTAINABLE TRANSPORT

4.1 Expert stakeholder visions of sustainable transport

Stakeholders' requirements for sustainable transport systems include technological and energy supply considerations, as well as sustainable levels of mobility and societal values that impact on travel choices (see Table 2).

There appeared to be widespread acknowledgement amongst expert focus group participants that hydrogen and other transport technologies are not the sole solutions for a sustainable road transport system. Rather, these technologies are seen as providing a possible solution to problems of emissions and energy security, as well as offering economic opportunities; but could not address wider mobility problems of, for example, congestion or social exclusion. The questionnaire findings on stakeholders' views of sustainable hydrogen-based transport also indicate that concerns about cost and level of mobility are not distinct from considerations of a hydrogen transition and should thus be incorporated into technology assessments (Whitmarsh & Wietschel, 2006).

Table 2. Sustainability criteria for transport/energy systems identified by expert stakeholders

Sustainability criteria	**Group(s) which mentioned criterion**
Renewable (inexhaustible supply)	All groups
Low/zero emissions - particulates and GHGs	Groups 2, 3
No toxic waste	Group 5
Energy supply security	Groups 2, 3, 4
Diversity of supply	Groups 1, 2, 4, 5
Flexibility/ synergy between sectors	Groups 1, 2, 3
Competitiveness	Groups 1, 2, 3, 4
Prices reflect real value/ externalities	Groups 1, 2, 4, 5
Efficiency	Groups 1, 2, 4, 5
Low/no congestion	Groups 2, 4
Available infrastructure	Groups 2, 3, 4, 5
Political and industrial support	Groups 1, 2, 4
Public support	Groups 1, 2, 3, 4
Safety	Group 4
Social inclusion	Group 1
Personal freedom	Groups 5, 3

Expert stakeholders felt that sustainable transport requires modal shift and reduced demand - through more public transport use, congestion charging, teleworking, internalising costs, and societal value change - as well as new transport technologies. Stakeholders raised social, economic and environmental criteria for sustainable transport. Indeed, stakeholders raised many of the aspects of sustainable transport considered in the Commission's *White Paper on the future Common Transport Policy* (European Commission, 2001a).

4.2 Citizen stakeholder visions of sustainable transport

Citizens' visions of future transport were explored through individual 'visioning' sheets and small-group discussions. The final self-completion questionnaires also elicited participants' preferred criteria for future transport. Comparison of the visions and questionnaire responses provides an insight into attitude change and learning through the citizen workshops.

Table 3 summarises the responses to the visioning exercise. *Overall, it is clear that modal shift and reduced demand are viewed favourably, while personal transport and a moderate amount of travel are also supported.* In respect of ideal transport systems, the most popular responses related to: use of, and improvements in, public transport; walking and cycling; local amenities/workplaces; but also cars and (some) centralised amenities/workplaces. Home-working and holidaying in the UK or Europe were also raised by several participants; more far-flung holidays were less popular. There was also some support for fiscal/policy change, such as congestion charging or severe taxes on most polluting cars. In terms of transport technologies, 4 participants wanted to see electric vehicles and 1 hydrogen transport in 2030. A further 5 also described more efficient and renewable-fuelled/clean vehicles.

Table 3. Responses to citizens' individual 'visioning' sheets: ideal and expected/real transport in 2030, and differences between the two visions

	Categories mentioned	**Ideal**	**Real**	**Difference**
Home	Rural/village	**6**	5	**-1**
	Urban	**5**	6	**1**
	Sub-urban	4	3	**-1**
	Floating house/ canal boat	1	1	**0**
Modes/technologies	Car	**12**	8	**-4**
	Air travel	4	5	**1**
	Public transport	**27**	16	**-11**
	Walk	**13**	10	**-3**
	Cycle	**12**	9	**-3**
	Car-share/pool, hitchhike, taxi	4	2	**-2**
	Electric vehicles	4	1	**-3**
	Hydrogen vehicles	1	1	**0**
	Clean/efficient vehicles	**5**	8	**3**

Table 3. cont.

Transport demand/alternative	Local amenities/workplace	**13**	8	**-5**
	Centralised amenities/workplace	**10**	12	**2**
	Home-working	**6**	7	**1**
	Video-conferencing	1	1	**0**
	Internet shopping	1	1	**0**
	Grow own food	3	1	**-2**
	Holidays/leisure UK	**6**	3	**-3**
	Holidays in Europe	**7**	5	**-2**
	Holidays in rest of world	2	3	**1**
Characteristics of transport system	Personal transport	3	0	**-3**
	Park-and-rides	1	2	**1**
	Reduced demand/more home-working	3	1	**-2**
	Modal shift	1	0	**-1**
	Improved/reliable/regular/integrated public transport	**17**	8	**-9**
	Safer/improved cycling facilities	4	1	**-3**
	No congestion/easy parking	2	0	**-2**
	Job creation	1	1	**0**
	Few planes	2	0	**-2**
	Improved air travel/ airport facilities	1	1	**0**
	Fast	2	3	**1**
	Fun, enjoyable	2	2	**0**
	Cheap	1	1	**0**
	Moving walkways replace roads	1	0	**-1**
	Virtual trams	1	0	**-1**
	Urban cable car system	1	1	**0**
	Fiscal/policy change (e.g., congestion charging)	**5**	2	**-3**
	Value change	2	0	**-2**
	No change from now /BAU	0	1	**1**
	Slow	0	1	**1**
	Expensive (e.g., inc. fuel prices)	0	3	**3**
	Security constraints	0	1	**1**
	Increased travel/more contacts	0	1	**1**
	Expanded airports/more air travel	0	3	**3**
	Wastelands/less greenery	0	1	**1**
	Little social interaction/few communities	0	1	**1**
	Poor quality/fragmented public transport	0	4	**4**
	More cars/lorries/congestion	0	6	**6**
	Pollution	0	2	**2**

Comparing the ideal and expected visions, we can see that there is little difference as regards the types of areas (rural, urban, sub-urban) in which participants saw themselves living in 2030. However, participants (particularly those in the EFTA workshop) were relatively pessimistic about the transport types and levels that would exist in 2030, compared to their ideals. The most prominent difference between ideal and expected futures is in respect of public transport: far fewer (16, compared to 27) saw themselves using public transport, while only 8 (compared to 17) believed it would be improved from current standards (and a further 4 explicitly stated it would be poor quality). Furthermore, several felt there would be more traffic/congestion and air travel, although the number mentioning car travel also decreased. In some cases, this was evidently because participants anticipated fuel prices and other costs to increase making travel, including car travel, more expensive and even unviable. At the same time, fewer expected workplaces and amenities to be local. *Overall, participants expected transport in 2030 to follow a business-as-usual pattern: suffering from similar (or worse) problems to the present day (e.g., congestion, fragmentation and pollution), while seeing some incremental technological improvements (e.g., more efficient vehicles). Participants nevertheless saw themselves as continuing to use public transport more often than private vehicles, despite few (or no) improvements being made to services.*

The small-group discussion (summarised in Table 4) revealed participants' interest in modal shift and, to a lesser extent, reduced transport demand (16). Slow modes (walking and cycling), localism (proximity to services, jobs, etc.), and public transport, particularly trams, were typically mentioned; although (consistent with their visioning responses) several also recognised the value of retaining some personal (motorised) transport.

In contrast, novel transport technologies (13) were less often mentioned. Those technologies that were mentioned were not restricted to vehicle/fuel technologies (e.g., bio-diesel) but included complimentary/supporting technologies such as GPS and ticket machines to improve efficiency of the transport system.

Criteria (34) were less commonly cited than particular modes (58) or measures (42), but where they were most often related to *integration* and, to a lesser extent, environmental and economic benefits.

Responsibility was implicitly or explicitly placed with governments on the whole, with infrastructural/physical and regulatory measures (e.g., banning cars from town centres) most commonly advocated.

To some extent participants also recognised uncertainties and trade-offs in their visions of future transport, notably in relation to energy sources.

It is striking that only 2 participants mentioned more futuristic options (urban cable car system; hover-boards), while the vast majority discussed currently-available options. In some cases, other European cities or countries were mentioned (e.g., Amsterdam, Copenhagen) as exemplars of successful transport systems. It seems, then, that participants considered an ideal transport system for Norfolk as emulating current European best practice, rather than consisting of radical innovations or technologies.

Interestingly, the findings from the small-groups suggest more ideas were generated through discussions than were included on the individual visioning sheets. While this may point to time constraints in completing the visioning exercise, it is also probable that the social process of discussion itself generated novel ideas amongst participants. *This highlights the value of multiple methods for knowledge elicitation.*

Table 4. Important features of transport identified in citizens' small-group discussions

Category	**No of times mentioned**
Modes:	
Public transport (general)	6
Trams	7
Buses	6
Trains	4
Park-and-ride	2
Boats	3
Communal/hired bikes	3
Car pools	1
Personal (motorised) transport	8
Air	1
Cycling	9
Walking	6
Futuristic (SkyTex cable car system; hover boards)	2
Reduced demand:	
Reduced demand (general)	4
Localism (proximity to services, jobs, etc.)	6
Home-working	3
'Smart'/coordinated deliveries	2
Boat houses	1
Technologies:	
Bio-diesel	2
Hydrogen	1
Water-powered	1
Dual-mode	1
Small/light/efficient	2
Ticket machines on buses	1
Luggage trolleys	1
GPS	2
Moving pavements	2

Table 4. cont.

Measures:	
Physical/infrastructural change	12
Economic	7
Legislation/regulation (e.g., banning cars from town centres)	9
Information/education	6
Environmental shock (e.g., oil prices)	3
Lifestyle/cultural change	5
Responsibility:	
Government/business/universities	2
Criteria/characteristics:	
Integrated	8
Low/no pollution	6
Cheap/affordable	4
Safe	3
Accessible	2
Aesthetic	2
Regular	2
Reliable	1
Job creation	1
Fun	1
Quick	1
Clean	1
Choice	1
Adapted to climate change (flooding)	1
Uncertainty/trade-offs (e.g., energy source, availability of land for biofuels, options for mobility impaired)	5
Cite other (European) cities/countries (Lyon, Amsterdam, Holland, Copenhagen)	5

The self-completion questionnaires present a similar picture of participants' preferences with respect to future transport. As summarised in Table 5, public transport was the most popular choice, followed by cycling. Reduced demand, new technologies, modal shift and attitude/behaviour change were also mentioned by more than one participant. *However, in contrast to initial visions, personal transport is barely mentioned.*

Table 5. Citizens' questionnaire responses to question: 'What are the most important features you would like to see in Norfolk's transport system in the future?'

Category	No of times mentioned
Improved/integrated public transport	7
Improved cycle facilities	5
Reduced demand/growth	3
New technologies	3
Modal shift	2
Attitude/cultural change	2
Car pooling	1
Sustainable car travel	1
Flexible working	1
Bus tracking	1
No need for much change in Norfolk	1
Zero-emission, accessible, cheaper	1
Cable car system	1

4.3 Citizens' perspectives on barriers to sustainable transport

Participants in the small group discussions identified a range of political/institutional (22), cultural (17), financial (13), physical (7) and technological (5) barriers to achieving their ideal transport future (see Table 6). Implicitly, participants recognised a number of 'lock-ins' to unsustainable transport, including physical and cultural dependence on cars.

The greater focus on cultural, political and institutional barriers, rather than technological obstacles, is consistent with the participants' visions which focussed on lifestyle changes. Here again, participants also implicitly placed responsibility with governments, with 3 participants explicitly expressing a lack of personal influence in respect of improved transport.

Table 6. Barriers to ideal transport identified in citizens' small-group discussion

Category	No of times mentioned
Financial:	
Money/economics (e.g., limited funding)	9
Corporate interests/profit motive	4
Cultural/psychological:	
Mindsets/preferences	4
Car culture	5
Unattractiveness of public transport	2
Individualism	1
Convenience/time pressures	3
Enjoy air travel	1
Want choice	1
Political/institutional:	
Lack of political will/leadership	5
Politics (general)	2
Short-termism	3
Risk aversion/inertia	3
Inconsistency (over time)	1
Dependence on fuel/oil	3
Lack of personal control/influence	3
Social inequality (e.g., rich can afford fines)	2
Physical lock-ins:	
Urban sprawl	2
Built-in dependence on cars	2
Distribution of social networks	1
Inadequate infrastructure for cycles	1
No local seaport	1
Technological:	
Technological indeterminism	3
Difficulties with energy sources (general)	1
Not enough biofuels	1

4.4 Citizens' preferences for sustainable transport technologies and policies

Consistent with participants' initial visions of their ideal transport system (section 4.2), the final voting exercise found modal shift and reduced demand were the most popular options for future transport (see Table 7). In general, technological options received fewer votes (although BA Festival participants rated hybrid cars relatively highly; similarly, the post-presentation discussion tended to focus more on technological queries than on behavioural/political ones at the BA Festival, while there was only two technological points raised following the EFTA presentations. It is possible that these differences could be accounted for by the differing interests of each audience, the BA Festival being a science event, and the EFTA event focussing on environmental issues).

There was virtually no support for a business-as-usual scenario.

Table 7. Outcome of final voting exercise in citizen workshops

'Vote on your preferred options for future transport:'	BA Festival	EFTA	**Total**
No change from present	0	1	1
Hydrogen and fuel cell cars/buses	7	4	**11**
Hybrid cars (e.g., Toyota Prius)	10	3	**13**
Biofuel cars/buses	6	1	7
More tele-working (i.e. working from home)	7	8	**15**
Jet packs	3	1	4
Congestion charging	4	5	9
Car sharing	5	3	8
'Home zones'	10	6	**16**
Car-free developments	10	28	**38**
Walking/cycling to work, shops etc. [EFTA workshop: walking & cycling separated at request of participants]	18	11 walk 23 cycle	**52**
Improved public transport	12	20	**32**
Suggestions added by participants:			
GPS	2		2
Bus tracking system	4		4
Improved road signage	4		4
Road-rail system (individual pods on tracks)	5		5
Bike pool	6		6
Car pools/hire		5	5

The self-completion questionnaires (Table 8) similarly expose the popularity of public transport, slow modes and reduced demand. Novel transport technologies were less commonly seen as solutions to transport problems.

Points raised during the post-presentation discussion included:

- rights of citizens versus the need for government to legislate and, in particular, ban cars;
- questioning the need for regional 'growth';
- the challenges of fostering cultural/attitudinal change;
- clarification about the process and impacts of hydrogen and fuel cell technologies (water vapour produced acting as a greenhouse gas);
- drawbacks of biofuels; and

- examples and advice relating to local transport issues (e.g., integrated bus ticketing across Norfolk; road surfacing; sourcing bio-diesel; home zones; dangerous cyclists).

Table 8. Questionnaire responses to question: 'Which, if any, of the options presented today do you think will do most to improve transport?'

Category	No of times mentioned
Improved/integrated public transport	5
Modal shift	3
Cycling/walking (and supporting facilities)	3
Reduced demand	3
Behaviour/value change	2
Fuel cells	1
Hybrid cars	1
Biofuels	1
Technology (general)	1
Transport information	1
Brownfield housing development	1
Education	1

4.3 Blurring the lay-expert divide

There was evidence from the expert focus groups that opinions expressed as 'experts' and organisational representatives sometimes conflicted with personal values and experiences. These examples illustrate disparity between organisational policies and personal views on sustainability:

"I think I'll switch the microphone off [laughs], because this is not the house line. I mean we definitely espouse from the European Commission side much greater use of inter-modal transport, and modal shift […] But as an actual user of public transport every day, I despair about its prospects really improving. It's not a particularly pleasant experience, it's not very reliable, in bad weather it's very unenjoyable […] I just don't think it can compete" (Policy stakeholder)

"In my very personal view, we should of course focus more on public transport […] and reduce car ownership of course, but as a representative of the automobile industry [laughs], there will be a demand for personal mobility in the future, but how we meet these demands has to be rethought …" (Automotive Industry stakeholder)

Indeed, we were surprised at the degree to which these stakeholders - many of whom would likely be 'winners' in a transition to a hydrogen economy - had such balanced and broad perspectives about hydrogen transport technologies. The reason for participants' reflexivity may be that, while these individuals are experts and stakeholders working for organisations with a stake in hydrogen, they also express personal opinions and experiences about transport. Many may also be aware of wider policy approaches to sustainable transport beyond simply hydrogen technologies. Consequently, the views expressed in these groups were often not 'the party line' (that is, their employer's policy) but a more balanced and nuanced perspective of sustainable transport and energy systems based on both personal values and professional expertise.

Conversely, as mentioned, participants in the citizen workshops were often well-educated and some had relatively in-depth knowledge about sustainable transport technologies and policies.

These observations highlight an important limitation of the distinction between the categories of 'expert' and 'non-expert', and 'scientist' and 'citizen'. All participants - in both the expert and non-expert workshops - are of course both transport users and citizens, regardless of the degree of 'scientific' knowledge they possess. In a sense, transport users may be defined as 'expert' since they hold first-hand experiential knowledge of transport systems (often in several countries). Furthermore, societal and environmental values inevitably influence personal perspectives on sustainable transport (which highlights the need to include a diverse range of societal groups in sustainability assessments, as discussed earlier). This blurring of the science-citizen and expert-lay boundaries is fundamental to post-normal (or 'Mode 2') science, and has been the focus of much study within the sociology of scientific knowledge (SSK) literature (Irwin, 1995; Wynne, 1992). This tradition has challenged the hegemony of scientific knowledge and argued for more reflexive and inclusive processes of social knowledge production. We consider the approaches adopted in this research to be effective in providing fora for a range of societal groups to deliberate and participate in sustainable assessment for transport. Furthermore, they allow for scientists and citizens to engage with and learn from each other to produce more socially-robust and reflexive forms of knowledge.

5 CONCLUSION

Drawing together and comparing the 'expert' and 'non-expert' perspectives on sustainable transport, we see broadly consistent criteria emerged across the two groups. Our findings indicate different stakeholder groups agree on the need to address problems of unsustainability in the transport sector, and identify broadly similar environmental, social and economic criteria for sustainable transport. Many of these have been raised in previous research (e.g., SUMMA, 2005) and are reflected in European transport policy aspirations (European Commission, 2001a). The expert discussions revealed that technology experts do not hold naïve views about the potential for technology itself to meet requirements for sustainability within the transport system. Rather, experts felt that sustainable transport requires modal shift and reduced demand - through more public transport use, congestion charging, teleworking, internalising costs, and societal value change - as well as new transport technologies. Similarly, citizen stakeholders rejected a business-as-usual approach and argued for modal shift, reduced demand and (to a lesser extent) transport technologies. Both groups also valued personal freedom and inclusive/accessible transport, and therefore tended to assume personal motorised transport would continue to play a role in society alongside other modes.

Expert stakeholders tended to place more emphasis on transport technologies than on behaviour change policies, while the converse is true for citizens. This is likely to be (at least in part) due to the nature of transport experts who participated in the workshops (i.e., primarily hydrogen technology experts). However, as discussed above, we have cautioned against reifying the distinction between experts and non-experts in the transport case, and argued for the value of inclusive processes of knowledge production.

Importantly, the citizen workshops also provided insights into the institutional dimensions of citizens' engagement in transport systems. Participants recognised 'lock-ins' to unsustainable transport and identified a range of cultural, political and institutional barriers to lifestyle change in favour of sustainable transport. Citizens, as well as experts (Whitmarsh & Wietschel, 2006), located responsibility for fostering sustainable transport primarily with governments rather than with society or themselves. The perceived lack of personal influence in respect of improved transport suggests a need to promote public engagement with transport issues and to improve alternatives to driving to encourage uptake.

Overall, our research indicates a need for integrated policy approaches to tackle unsustainable transport by addressing the *socio-cultural and structural* determinants of transport demand, as well as by offering technological solutions. Pathways to sustainable transport with both technological and behavioural elements are necessary.

It has been argued elsewhere (European Commission, 2001b; Whitmarsh & Wietschel, 2006) that sustainable transport demands long-term planning and systemic, cross-sectoral rather than end-of-pipe, policy solutions. We have here presented research that informs such an integrated policy approach, by drawing on stakeholder perspectives to develop long-term sustainable transport visions. The role of stakeholders in this process fulfilled the three functions (normative, substantive and instrumental) outlined earlier. Participants drew on their professional expertise, personal values and diverse experiences in defining a sustainable transport future and exploring practical challenges in achieving it. Furthermore, there was evidence of learning as a result of stakeholders' participation in the discussions: one-third of expert stakeholders and one-quarter of citizen stakeholders felt they had changed their views during the course of the discussions; and most identified things they had learnt from the discussions, including technical knowledge and new perspectives. Future work will draw on the unique experiences of other transport stakeholders not represented in this current study in defining sustainable transport visions and identifying appropriate and socially-acceptable technologies and policies.

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