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A social perspective on sustainable transport policy: A case study on car road pricing in Austria

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Abstract

The current transport system in industrialised countries is far from being sustainable, partly due to the negative impacts of motorised individual transport. Car road pricing would present a policy instrument to reduce the transport volume and to change the modal split. However, its effects go beyond the transport system itself and influence the different dimensions of sustainability, especially the social dimension.

In the present paper the impacts of different car road pricing scenarios in Austria are discussed. It aims to present the operationalisation of the social dimension and its significance in relation to the other dimensions of sustainability, often represented by a trade-off. Results concerning the impacts of car road pricing on the Austrian population are discussed with regard to the feasibility and acceptance of such a measure. Different options to overcome the negative acceptance of road pricing or to reduce the trade-offs are suggested.

Keywords: Sustainable transport policy, car road pricing, social dimension of sustainability, public acceptance, participation.

1 The meaning of sustainable transport

It is widely known and acknowledged that the current transport system (persons and goods) in industrialised countries like Austria is far from being sustainable. It produces negative impacts on natural and socio-economic systems by producing emissions (mainly CO_2[1] and particles), noise, congestion, accidents, health

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[1]The transport sector is responsible for 25% of the GHG emissions in Austria, being the second main contributor after the industry and has the highest growth rate; increase of 82% between 1990 and 2003. (UBA, 2007)

problems, limited regional cohesion and by requiring a high material and energy input to maintain the transport infrastructure and the transport stock (for the Austrian situation, see Herry, 2002). Considering passenger transport, excessive motorised individual transport is predominantly responsible for the negative impacts. A move towards more sustainable passenger transport in Austrian cities therefore requires a reduction in the transport volume and changes in the travel mode choice (modal split) towards public transport. The introduction of car road pricing may be a way to achieve this.

Sustainable transport means the realisation of a long-term tolerable mobility of persons and goods that still satisfies transport requirements. In estimating the effects of policy measures that aim for sustainability in transport, four main dimensions have to be taken into account (Valentin & Spangenberg, 2000; Spangenberg, 2002; Goodwin, 2003). They are the economic (attainment of positive impulses for economic development), the environmental (improvement of life conditions and environmental quality), the social (enhancement of social cohesion) and the institutional (improvement of transport conditions, organisations, legal conditions etc.) dimensions.

The social dimension is fairly neglected in the current European transport policy and also in its research or, if addressed, it is measured in monetary terms within cost-benefit analyses[2]. Nevertheless, this dimension plays a crucial role. Besides distributional impacts and matters of inequity, the main implication of the social dimension of transport policy is public acceptance. Changes in transport policy that are aiming at a reduction of individual transport and an increase in public transport usually result in public protest and low political support (Jones, 1998; Jakobsson et al., 2000; Harsman, 2003). A political measure such as car road pricing, which forces some people to pay for a service that has so far been free (for the individual, as social costs have been paid by all), does of course lead to opposition. The public discussion is further complicated by very emotional arguments of the involved users, such as the fear of being confined if no flexible means of transport are available or affordable or of a supposed change in one's lifestyle.

The research project 'Technologies and effects of car road pricing', running from November 2002 until April 2004, builds the empirical basis for this paper (Steininger & Gobiet, 2004)[3]. In this project several road pricing scenarios for Austria were developed. Their impacts on the four above-mentioned dimensions were analysed and then evaluated in a multi-criteria analysis.

Based on the results of this project, the current paper aims to show for the case of car road pricing

- the importance of the social dimension in transport policy,

[2]See for instance: OECD 1996, 1998, 1999*a*,*b*, 2000*a*,*b*; research projects: TIPP (University of Leuven); SPECTRUM (University of Leeds); PROSPECTS (University of Vienna); TRENEN (University of Leuven).

[3]This paper is also based on the Ph.D. thesis of the first author, who applied this project as one of two case studies to examine the appropriateness of multi-criteria decision aid for sustainable development analysis and implementation (Omann, 2004).

- conflicts and trade-offs between the different dimensions of sustainable transport, and
- suggestions on how to address conflicts involving the social dimension.

In Section 2 we present the methodological framework of the project, followed by a more detailed analysis of the assessment of the social dimension in Section 3. The evaluation of the scenarios and resulting trade-offs including the social dimension are shown in Section 4, whereas in Section 5 we suggest options to address those trade-offs and conclude in Section 6 with policy implications.

2 The methodological framework for the social analysis of road pricing

Road pricing is a price mechanism, based on the idea of internalising external costs. Charges are levied on road users, making the polluter pay her/his private and the social costs. These charges can be based on length of trip, time of trip, road network and various other characteristics.

If road users have to pay, they should be inclined to change or even reduce their traffic behaviour and therefore bring the transport system to a sustainable level. The most often cited tasks of road pricing besides congestion reduction are fundraising for the improvement of the transport infrastructure and the reduction of the negative impacts on environment and health (see, e.g., Jones, 1995; Steininger & Gobiet, 2004; Teubel, 2001).

As mentioned above, the aim of the project was to suggest car road pricing options and to show their impacts. Therefore different scenarios were defined, which vary regarding the priced road network, the charge levels, peak hour differentiations and different frameworks for the revenue use. Four scenarios plus the reference scenario, presenting the status-quo without car road pricing (business-as-usual, BAU), were used for the evaluation (see Table 1). In the evaluation of the social dimension an additional scenario (D-5) was assessed to show the social impacts of different revenue uses.

All scenarios contain a satellite-based charging system that tracks each individual car, because it is the technologically most sophisticated solution and allows full differentiation of the charge level by time, region and many more. For the sake of simplification, other designs of road charging systems were not examined.

Although these scenarios are arbitrary, they are realistic in so far as they reflect the intentions of Austrian policy makers and the current technical possibilities. In order to prevent evasion of the charge by shifting to lower ranked roads and to apply the price mechanism extensively to all trips, the whole road network is addressed by the tax in all scenarios but one.

A-5 represents the weakest version of road pricing with 5 cents per km levied only on higher ranked roads and without peak hour differentiation. C-10 on the other hand is the strongest version of the proposed scenarios with 10 cents basic

Table 1: The different road pricing scenarios. Source: Omann, 2004, p. 210.

Scenario	Road network	Base charge	Peak/ Congestion	Revenue use		
				Transport Infrastructure	Public transport	Social compensation
Scenario A-5	higher ranked road network	0.05€/km	—	1/3	1/3	1/3
Scenario B-5	all roads	0.05€/km	—	1/3	1/3	1/3
Scenario C-5	all roads	0.05€/km	+100%	1/3	1/3	1/3
Scenario C-10	all roads	0.10€/km	+100%	1/3	1/3	1/3
Scenario D-5	all roads	0.05€/km	+100%	1/9	5/9	3/9

charge on all roads and 20 cents at peak times in congested areas (the major cities of Austria).

For each of the four dimensions a separate methodological approach was used to estimate the scenarios' impacts[4]. These are:

- Transport dimension: A passenger transport demand model developed by Kriebernegg (2004) to calculate the change in the transport volume (vehicle-km) per year, the change in the passenger volume (passenger-km) and the change in the modal split. These results were also used as input for the economic model and for the estimation of the environmental impacts.
- Economic dimension: A computable general equilibrium model (CGE) (Steininger & Gobiet, 2004) was developed and applied to calculate impacts on macro-economic figures.
- Environmental dimension: Most environmental impacts were calculated by extrapolation of data given in the relevant literature.
- Social dimension: A survey of 100 Austrian car owners was carried out. Results on expected behavioural changes were used to validate the transport model.

The results of these four approaches provided the data basis for the multi-criteria analysis (MCA), which finally served to compare the scenarios regarding their impacts on all dimensions and to show conflicts between the dimensions[5]. So the assessment of the social dimension was embedded in a framework that allowed the analysis of the social impacts of car road pricing as well as the interrelation between the social and other dimensions.

[4]For a detailed description of the models uses, see Steininger & Gobiet (2004).

[5]As this paper does not focus on the analytical and empirical background of the MCA, we refer the reader to Omann (2004, ch. 4 and 5) for any details about the analysis.

As the emphasis of the present paper is the social dimension of transport policy measures, no further details about the other dimensions and their evaluations are given. For an overview of the criteria, evaluations and impacts of the other dimensions, see Table 5.

3 The social dimension and its assessment

The social dimension of transport policy deals with the impacts of a measure on the social cohesion in the affected population and the subjective perception of the measure. Car road pricing mainly intends to reduce traffic and pollution, but it could also lead to side effects such as inequity between regions or populations groups. Understanding such potential detrimental effects makes it possible to balance or compensate them and thereby achieve higher public acceptance of the planned measure.

The assessment of the social dimension must not be confused with the assessment of public acceptance. Public acceptance is deeply interconnected with the social dimension as it is operationalised here, but also includes environmental and political attitudes, lifestyles and much more. To achieve public acceptance, positive impacts on the social dimension, but also on the economic and environmental dimension must be accomplished when implementing transport policy measures. One way to achieve public acceptance is the participation of stakeholders, which is discussed in Section 5.

Special emphasis is put in this paper on methodological issues that could be relevant for research projects in other nations, whereas the results are limited to the Austrian situation. Nevertheless the results are provided in detail because the project showed that any reference values are hard to find. It should be kept in mind that the methodological framework for the assessment of the social dimension applied here represents a preliminary attempt to grasp this subject (see Section 6). The project funding did not allow for a more comprehensive assessment, so our survey may not be sufficient to cover the whole social dimension, but it covers the important issue of acceptance and is thus not an inadequate tool.

3.1 Operationalisation of the social dimension

In our framework of sustainable transport, three objectives were defined to reflect the social dimension. Table 2 shows the objectives and their operationalisation[6].

Fulfilling the objective of *personal basic mobility* means that people are not severely impeded in undertaking their necessary trips and are largely able to maintain their current way of living. *Socio-economic fairness* covers the fair distribution of all effects among the concerned population groups. *Regional*

[6]Please note that these items have been translated from the German questionnaire used in the survey. To obtain the original questionnaire, please contact the authors.

Table 2: The objectives for the social dimension and their operationalisation

Objective	Operationalisation
personal basic mobility	• domains of private life, where the range and availability of transport would be restrained • changes in the planning of trips and in lifestyle
socio-economic fairness	• perceived general equity • perceived horizontal/intrapersonal equity: fair share of the costs one causes by driving • perceived vertical/interpersonal equity: improvement of transport accessibility for people currently disadvantaged
regional cohesion	• being cut off from the next town centre • differentiation of the results on personal basic mobility by urban and rural region

cohesion means that satisfactory personal basic mobility is given regardless of weak transport connections in rural regions.

Some operationalisations focus only on negative outcomes. This restriction was deliberately chosen, because prior experiences of the project team made us expect primarily negative responses, and the overall complexity of the questionnaire called for brevity in the number of questions. These expectations were confirmed, as the balanced scales also yielded only negative responses.

3.2 Methodological background

To estimate the effects of car road pricing on these criteria, we decided to conduct a survey among Austrians who have a car at their regular disposal and would therefore be directly concerned by car road pricing. Respondents from the whole Austrian territory were asked in face-to-face-interviews to assess the five car road pricing scenarios by imagining the major changes in their lives they presumably would have to face. There has been no notable public discussion on car road pricing in Austria so far; thus the respondents had to estimate changes resulting from a scheme they did not yet know. We solved this problem by providing a simple fact-sheet on car road pricing, by giving stepwise more complex scenarios and by referencing to everyday life in asking for changes on typical and regular trips, which were defined individually beforehand. This reference to everyday life also intended to facilitate the task of assessing fictitious scenarios and estimating one's future behaviour[7].

When using surveys for the prediction of behaviour, one should keep in mind that self-reported behavioural intentions (stated preferences) usually overesti-

[7]Difficulties in the assessment of fictitious scenarios were the main reason why people without a car were not included in the sample. They would only be indirectly concerned, by the changes in other's transport behaviour or by the framework of revenue use, what makes a valid assessment even harder for them. Moreover, 75% of the Austrian households possess at least one car (Statistik Austria, 2000).

mate the actual change in traffic behaviour. Observed reactions (revealed preferences) on the other hand are much more reliable (Franzen, 1995). For the prediction of future impacts it is obviously necessary to measure stated preferences, but we recommend interpreting them as the upper limit of expected behavioural changes.

Another methodological problem we faced was the limitation to a sample of $n = 100$ due to small project funds, leading to error intervals of at least $\pm 9.8\%$ and limited possibilities to differentiate between population groups. To ensure the results, all social objectives were assessed using several items per objective, part of them designed as qualitative questions. Using this multi-item approach, it was possible to support tendencies that did not reach statistical significance due to the small sample size. Additionally, the representativeness of the sample was checked by comparing the distribution of socio-demographic variables such as age, income, education and yearly traffic performance in the sample with the distribution in the whole Austrian population. In most variables, a high congruence was achieved (see Table 8).

The questionnaire was developed on the basis of previous social research projects on car road pricing in Austria and Switzerland (Herry & Snized, 1992; Güller et al., 2000). Before starting the survey, the questionnaire was reviewed in a pre-test for practicability and comprehensibility.

3.3 Overview of the survey results

For nearly all social objectives the same ranking of scenarios was found. The weakest scenario A-5 leads to slight aggravation, the intermediate scenarios B-5, C-5 and D-5 lead to a moderate aggravation, and the strongest scenario C-10 would result in a strong aggravation of the social dimension. This ranking was transformed into a qualitative scale used for a multi-criteria analysis which was applied to rank the scenarios.

The respondents themselves chose the same ranking when asked which scenario they would accept most, if car road pricing were implemented. The lower the individual costs and the smaller the charged road network, the more a scenario was accepted.

3.4 Results on personal basic mobility

Regarding personal basic mobility, the number of people facing restrictions in the range and availability of transport increases with the strength of the car road pricing scenario. This is particularly true for the domain of leisure, where the major part of trips is undertaken spontaneously and to different destinations and requires a flexible means of transport—mostly the car (Hautzinger, 1997). On the other hand, there is a rather high percentage of respondents who explicitly state that they would face no restrictions (up to 54.1% in scenario A-5). This result is of importance when considering public acceptance. Table 3 shows the percentage of respondents who would be restrained in the specific domains.

Table 3: Restrictions in domains of private life. Base: $n = 100$. Percentage of respondents who would be restrained in the specific domain. Multiple responses allowed. Error interval ±9.8%.

	A-5	B-5	C-5	D-5	C-10
all domains	3.1%	3.2%	8.2%	10.3%	15.6%
leisure	25.5%	33.0%	40.2%	44.3%	50.0%
shopping	5.1%	16.0%	13.4%	14.4%	13.5%
work/education	8.2%	10.6%	9.3%	12.4%	15.6%
social life	7.1%	6.4%	6.2%	6.2%	4.2%
financial restrictions	5.1%	6.4%	4.1%	6.3%	5.2%
freedom, flexibility, spontaneous activities	5.1%	11.7%	16.5%	18.8%	16.5%
no restrictions	54.1%	39.4%	28.9%	22.7%	10.4%

Most changes occur in the planning of trips and in everyday transport decisions, such as a general reduction of car trips or an increase of combined trips (e.g. shopping or leisure activities after work). Fundamental changes in lifestyle such as giving up one's car or one's place of work or living were raised by few respondents, mainly in scenario C-10. In scenario C-10, 21.0% would give up their car completely.

3.5 Results on socio-economic fairness

The assessment of socio-economic fairness also shows the aforementioned ranking in general equity and horizontal equity, which is shown in Table 4. General equity is the perceived overall socio-economic fairness. Horizontal equity means that the costs of driving are shared in a fair way among people with the same access to transport. Vertical equity means that people who are currently disadvantaged regarding transport accessibility experience an improvement of their conditions (see Table 2).

This ranking underlies the assessment of car road pricing as being unfair, because of disadvantages due to individual costs. Between 28.1% (scenario B-5) and 69.7% (scenario C-10) of the respondents stated this reason. Other important reasons are infrastructural disadvantages (e.g. in regions with insufficient availability of public transport) and disadvantages for specific population groups (commuters, elderly people). The main reason for assessing car road pricing as fair is a willingness to pay for road usage to reach a reduction in negative environmental impacts or to maintain the road infrastructure.

The different frameworks of revenue use in the scenarios C-5 and D-5 result in a slightly better assessment of D-5, especially on vertical equity. Moreover, in D-5, the revenue use was stated by 31.6% as reason for assessing car road pricing as fair. People seem to consider it fairer if a significant part of their mobility expenditures, which would be increased by car road pricing, is used to provide a transport alternative which allows them in turn to decrease these expenditures.

Table 4: Perceived equity of the road pricing scenarios. Base: $n = 100$. Mean values on a five-point-rating scale from 1 = very fair to 5 = very unfair.

	A-5	B-5	C-5	D-5	C-10
general equity	3.6	4.0	4.4	4.2	4.8
horizontal equity	3.6	3.8	4.2	4.1	4.6
vertical equity	4.3	4.2	4.2	3.8	4.3

3.6 Results on regional cohesion

Considering regional cohesion, the impacts of car road pricing are significantly lower in urban than in rural regions[8]. Inhabitants of rural regions state more often restrictions in work/education and shopping, whereas respondents from urban regions expect to be restrained in 'freedom, flexibility, spontaneous activities'. Thus, people from rural regions are more restrained in domains which cannot easily be substituted in everyday life. In addition, they more often state that they would be forced to change their place of living.

On the other hand people from urban regions would more often give up their car completely, as public transport offers currently a more attractive alternative in travel mode choice there than in rural regions. Especially on leisure trips, people from urban regions are more willing to switch to public transport than people from rural regions.

In all scenarios, the respondents do not perceive to be cut off severely from the next town centre, so there is no extreme impact of car road pricing on regional cohesion; however, people from rural regions would be more affected.

4 Trade-offs in the case of car road pricing

The obtained rankings of the scenarios on the three social objectives were transformed into qualitative scales and provided input for a multi-criteria analysis. This MCA was used to aggregate over all impacts of the five scenarios on the four dimensions—represented by 14 criteria (Omann, 2004). From this evaluation a ranking of the scenarios was obtained, which is based on their impacts and on the importance of the criteria[9]. In order to carry out such a MCA the impacts on all criteria have to be calculated or generated and presented in an impact matrix (see Table 5); for that purpose the other models were used (see Section 2).

[8] Definition of urban and rural regions is according to the Austrian Conference on Spatial Planning (ÖROK, 1990).

[9] The importance was given to them in form of weights by a group of stakeholders (project advisory board and project sponsors).

Table 5: The impact matrix for the car road pricing scenarios. Source: Adapted from Omann (2004, p. 214). This table shows the impacts of the scenarios on the dimensions of sustainable transport. These dimensions are operationalised via criteria, which are measured by quantitative or qualitative indicators. Is the aim to maximise a criterion (e.g. income) the direction of the indicator given is "max" and vice versa. The impacts were calculated and generated via different models (see Section 2) or via the social survey explained in this paper.

			Scenarios				
Criteria	Indicators	Direction	BAU	A-5	B-5	C-5	C-10
Improvement of transport conditions							
Minimal transport quality	Quality of transport flow[10]	Max	1	2.6	2.8	2.8	3.8
Accessibility conditions	Reduction of travel time MIT[11]	Max	1	1.8	1.8	1.8	2.8
	Reduction of travel time PT[12]	Max	1	1	1	2	2
Safety	Ratio of reduction of accidents to total amount of accidents	Min	1	0.95	0.93	0.93	0.85
Transport volume	Mio km MIT	Min	63,068	59,838.9	58,981.2	58,823.5	53,961
Improvement of life conditions and environmental quality							
Ecosystems' functions	Total amount $CO_2$1000t	Min	12,395	11,826	11,673	11,651	10,814
	Total amount CO 1000t	Min	190	180.5	177.9	177.5	163.3
	Total amount NOx 1000t	Min	45	43.4	43	42.9	40.6
	Total amount SO2 1000t	Min	1.88	1.81	1.79	1.78	1.67
	Total amount CH4 1000t	Min	1.48	1.41	1.39	1.38	1.27
Efficient resource use	Energy input: total amount for cars in Mio TJ	Min	158,626	150,536	148,315	147,998	135,942
Life quality and health	Noise pollution[13]	Min	1	1	1	2	2
	Total amount PM10 1000t	Min	2.4	2.3	2.3	2.3	2.1
Attainment of positive impulses on the economic development							
Economic welfare	Degree of internalisation of external costs: %	Max	0	26.5	44	48.7	97.3
	Mio €/y GDP in purchasing power	Max	204,616	204,064	203,920	203,900	202,652
	Mio €/y green GDP	Max	201,884	201,490	201,384	201,370	200,331
Regional welfare	Economic regional development[14]	Min	1	1	1	1	2
Employment	Unemployment rate: %	Min	5.84	5.86	5.80	5.80	6.12
Income	Mio €/y revenues	Max	0	1,085	1,671	1,742	3,489
Enhancement of social cohesion							

[10] qualitative scale from 1 to 4: 1: unimportant change (0–3% reduction of trips), 2: slight improvement (4–8% reduction of trips), 3: strong improvement (9–15% reduction of trips) 4: very strong improvement (>15% reduction of trips)

[11] qualitative scale from 1 to 3: 1: no/slight change; 2: moderate improvement; 3: strong improvement

[12] qualitative scale from 1 to 3: 1: no/slight change; 2: moderate improvement; 3: strong improvement

[13] qualitative scale from 1 to 2: 1: no change; 2: slight improvement

[14] qualitative scale from 1 to 2: 1 no change; 2: slight aggravation

Table 5: The impact matrix for the car road pricing scenarios. Source: Adapted from Omann (2004, p. 214). This table shows the impacts of the scenarios on the dimensions of sustainable transport. These dimensions are operationalised via criteria, which are measured by quantitative or qualitative indicators. Is the aim to maximise a criterion (e.g. income) the direction of the indicator given is "max" and vice versa. The impacts were calculated and generated via different models (see Section 2) or via the social survey explained in this paper.

			Scenarios				
Criteria	Indicators	Direction	BAU	A-5	B-5	C-5	C-10
Personal basic mobility	Subjective perception[15]	Min	0	1	2	2	3
Regional cohesions	Social regional cohesion[16]	Min	0	1	2	2	3
Socio-economic fairness	Subjective perception[17]	Min	0	1	2	2	3

The impact assessments of the scenarios show ambivalent results. Road pricing has in general positive effects on the mobility dimension and on the environmental dimension, as the environmental indicators were linearly extrapolated from the estimated changes in transport volume[18]. The stronger the scenario is (higher charges, levied on all roads, peak hour differentiation) the better the effects are. The economic impacts are diverse. On some indicators they are positive (the stronger the scenario the better), such as internalisation of external costs or generation of income; on other indicators the effects are slightly negative, such as on GDP, the unemployment rate or on regional economic welfare. And finally, the impacts on the social dimension are negative throughout.

Thus, there are considerable trade-offs between the mobility and the environmental dimension on the one hand and the social dimension on the other (see Figure 1). This is an interesting result as it opposes the often prevailing opinion about mainly existing conflicts between the economy and the environment. There are some conflicts between the economy and the environment, as with strong positive effects on the environment and parts of the economic dimension, the GDP and the regional economic welfare are reduced, but only slightly.

Based on the impact matrix (Table 5) and weights attached to the criteria, a multi-criteria analysis using the PROMETHEE method (Brans & Mareschal, 1990) was undertaken.

The basic result of this analysis is shown in Table 6 as well as the ranking resulting from a MCA version where the main emphasis in terms of high weights, is put on the social criteria. The latter result corresponds with the result of the social survey.

[15] qualitative scale from 0 to 3: 0: no change; 1: slight aggravation; 2: moderate aggravation; 3: strong aggravation

[16] qualitative scale from 0 to 3: 0: no change; 1: slight aggravation; 2: moderate aggravation; 3: strong aggravation

[17] qualitative scale from 0 to 3: 0: no change; 1: slight aggravation; 2: moderate aggravation; 3: strong aggravation

[18] We are aware that linearity presents only an approximation to the real correlation between transport volume and environmental effects

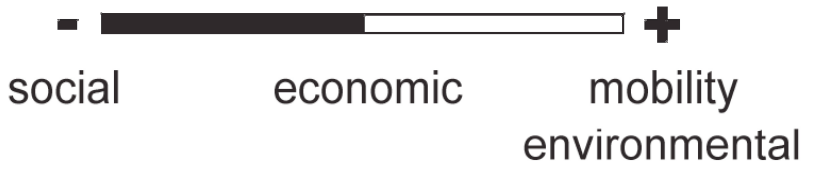

Figure 1: Impacts of car-road pricing on the dimensions of sustainable transport.

Table 6: Ranking of the road pricing scenarios. Weights attached: MCA basic: mobility: 25%, environment: 34%, economy: 25%, social: 16%; MCA social: mobility: 14%, environment: 19%, economy: 13%, social: 54%

Rank	MCA (basic)	MCA (social)
1.	C-10	BAU
2.	C-5	A-5
3.	A-5	C-5
4.	B-5	B-5
5.	BAU	C-10

The basic MCA suggests C-10, the strongest road pricing scenario followed by the second strongest option, whereas not implementing road pricing at all (= BAU) is the least preferred option. This contradicts the result of the multi-criteria analysis with the majority of the weights on the social dimension. In that case it would be most preferred not to introduce car road pricing at all and if, then as a weak option. This result reflects the above mentioned trade-offs between the social and the other dimensions. It also shows very clearly that the implementation of car road pricing in Austria would lead to a strong public opposition and therefore to weak or no acceptance of the measure. For decision makers it is thus important to consider measures to either reduce or solve these trade-offs.

5 Suggestions to address the trade-offs

The findings from the MCA show that the social dimension is in strong opposition to the other dimensions. There are two extreme, but nevertheless quite common positions to solve this conflict of interests when introducing a transport policy measure: Either by overruling the social dimension, arguing that the public has to accept inconveniences and disadvantages in order to reach a greater common goal such as the reduction of CO_2 emissions; or by favouring the social dimension over benefits in the economy or in the transport sector and relying on short-term measures to avoid losses at the next elections.

Successful and effective compromise solutions are hard to find. Introducing a pluralistic approach, where accompanying measures attempt to lessen negative outcomes, is in general a promising option; however, it implies the danger of weakening the finally obtained effect. A compromise solution that considers the interests of all relevant stakeholders might make too many concessions so that the introduced measure results in no significant impact, which again reduces future support of the measure.

Oberholzer-Gee & Weck-Hannemann (2002) propose to compensate those who lose with compensations that lie in the same 'dimension' as the losses. For instance, individuals rather accept reduced accessibility to roads if there are improvements of road infrastructure or of public transport. Also Ferrari (2002) suggests to spend revenues from a toll inside the transportation system, e.g. for improving the public transport.

5.1 Participation of stakeholders

Social inclusion in form of participation of stakeholders and appropriate information seems to be the method of choice when implementing severe measures in transport policy. In our survey, 59.0% of the respondents said that they always want to participate in planning and decision processes concerning changes in the transport system; 32.0% wanted to do this at least most of the time. Only 5.0% did not wish to participate. The remaining 4.0% stated no preference.

Participation in the form of deliberative processes[19] (Jacobs, 1997; O'Neill, 2001; Bloomfield et al., 2001; Holmes & Scoones, 2000) has not been practised in Austria so far in transport policy; it presents a challenge for policy makers who have to explore how inclusion of the public in the transport decision-making and governance processes can be secured and conducted (Hodgson & Turner, 2003).

Regarding the preferred way of participation, the majority of respondents demanded a referendum or putting pressure on decision makers with the help of signature lists (see Table 7). Nevertheless, a significant part of the respondents also stated a preference for information-oriented measures.

In most cases, supporting information-oriented measures besides a referendum are desired. From the survey results[20] and our experience, we can conclude that no serious participation culture currently exists in Austria. The public prefers one way communication rather than deliberative processes.

[19] They are processes of social interaction between different groups, characterised by acceptance and respect of others values, interests, and opinions. They can lead to a consensus or vote, but do not necessarily do so. The process itself is important. It includes social learning and the formation of trust, and allows for the generation of workable outcomes in situations of conflicts and disagreement. They do not only achieve understanding or consensus in decision making, they also have transformative potential, as the respected knowledge is broadened and those who usually have a limited voice can influence decisions (Omann, 2004).

[20] The survey showed a very low contentedness with the existing possibilities for participating in transport planning (mean value 4.3 on a five-point-rating scale from 1=very content to 5=very discontent).

Table 7: Information- vs. decision-oriented ways of participation. Base: $n = 85$. Error interval ±10.6%. Multiple responses allowed.

Preferred way of participation			
information-oriented		decision-oriented	
information via radio or TV	64.8%	referendum	90.1%
information brochures	48.4%	signature lists	61.5%
road show with experts	33.0%	round table with decision makers	38.5%
information and discussion via internet	24.2%		

5.2 The use of revenues

Another way to increase public acceptance is the implementation of a framework for revenue use that for instance favours the extension of public transport and thereby the availability of attractive transport alternatives. It is best to initiate such measures before road pricing is implemented. People should be more willing to accept car road pricing, if they can easily substitute their car trips with buses or railways. Another advantage of using the revenue for public transport is that least advantaged people, who are dependent on public transport anyway, as they do not possess a car, are given a better service, wider coverage and cheaper access (Viegas, 2001).

In scenario D-5 5/9 of the revenues would be used for public transport and only 1/9 for transport infrastructure. In a general ranking of all scenarios by the respondents D-5 achieved nearly the same rank as C-5, where no special emphasis was put on public transport. Nevertheless, it was perceived more equitable than C-5. Thus, the general preference of a certain scenario is not solely a matter of equity, although there is strong influence of perceived fairness on the acceptance of car road pricing (Jakobsson et al., 2000). When the respondents were asked for their desired distribution of the revenues, the mean revenue use corresponded to the three equal shares as they were presented in the four other scenarios A-5, B-5, C-5 and C-10.

There seem to be three underlying difficulties in frameworks for revenue use:

- Many people do not trust the decision makers to use the revenues as promised after implementing car road pricing.
- For lay people it is hard to visualise what would happen or would be achieved if revenues gained by car road pricing are used for a certain issue. The acquired and needed amounts of money are widely abstract to them. In the survey, especially the area of social compensation was affected by this problem.
- It takes years until construction of public transport infrastructure is completed. Hence, there is a large temporal distance between the implementation of car road pricing and the levying of the tax on the one hand and the

extension of transport alternatives and the increasing of public acceptance on the other hand.

These difficulties again stress the necessity to provide extensive information on car road pricing, its aims and its future benefits to the public and to start with improvements of the transport system before implementing car road pricing.

5.3 Compensatory measures

A third option to alleviate the negative social effects, is to implement compensatory measures simultaneously, which support losers of car road pricing such as commuters with bad or no access to public transport, who do not have a chance to change their place of living or place of job, disabled persons, who need to travel by car, people without reasonable access to public transport, etc. One form of compensation is to reduce labour taxes (Oberholzer-Gee & Weck-Hannemann, 2002; Hinterberger & Stocker, 2004), another one is to reward environmentally conscious behaviour of individuals who change their modal split away from car use. In any case, compensatory measures have to be planned carefully (who are the beneficiaries, timing, scale) not to weaken or counteract the primary effects of car road pricing (reduction of motorised individual transport, change of modal split).

Besides public participation, frameworks for revenue use and compensatory measures, there still remains an option to address the trade-offs between the social and the other dimensions. In choosing a weak version of car road pricing the positive impacts on the economic, environmental and mobility dimension could be reduced in order to decrease the negative impacts on the social dimension. This means inverting the trade-offs, not really solving them.

6 The social dimension of car road pricing—conclusions

Given the circumstances and restrictions in our research, we can conclude that car road pricing is an efficient measure to reduce the transport volume and therefore its impacts on the environment, without compromising the national economy. However, severe negative impacts on the individual users of the transport system and low public acceptance can be expected. Several approaches to offset these impacts were discussed, namely participation, improvement of the transport system or compensatory measures via revenue use.

We consider it far too optimistic to assume that public acceptance could be easily reached on a short-term basis by participation of affected population groups. Pro-environmental attitudes and a willingness to pay for road use take some time to develop. Accompanying the implementation of car road pricing with a broad participation of the public and initiating a public discourse takes a couple of years and is thus not an easy-to-implement objective besides the public scepticism. Real life examples like the city toll in London, where a surprisingly

high public acceptance for car road pricing was achieved in a short time, should be accompanied by social research during their implementation to gain insights in the politicial, economic und social determinants of public acceptance.

Another conclusion is that there is a need for pluralistic solutions. A fundamental change of the transport system not only requires political support but also a broad reform strategy containing policy measures aiming at this change and at counteracting the negative effects. Even in the strongest car road pricing scenario C-10, the annual transport volume is only reduced by 9.1% (see table 3)—a rather small change that will rapidly be offset by the regular annual growth in car transport volume (+18.0% from 1995 to 2000 in the higher ranked road network; see Herry, 2002).

Such a strategy could contain besides car road pricing, well known measures as extension and improvement of public transport, consideration of bicycle users in urban planning, enhancement of public awareness, support of car sharing, better park & ride facilities, and energy taxes.

Basic methodological problems of the assessment of the social dimension with the help of surveys have been discussed, such as the difficulties of respondents to evaluate fictitious and unfamiliar characteristics of the transport system. Although it is of utmost importance to include the subjective views of affected population groups, a comprehensive assessment of the social dimension also requires objective criteria. These could be, for example, effects on health and quality of life indicators.

In reviewing the relevant literature and in discussing with transport policy experts, we found that the terms social dimension, institutional dimension, public opinion, public acceptance and public participation are used in an intersecting way and have yet to be clearly defined and differentiated.

It became clear throughout the research for this paper that in the case of sustainable transport the inclusion of the affected citizens and social groups is a prerequisite for comprehensible, applicable and accepted research results. We hope that future socio-political processes on sustainable transport will consider the importance of public participation as well as put emphasis on the social dimension of proposed changes.

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Table 8: Comparison of sample and population. Sources: survey, Statistik Austria (2001); Herry (2002). The high congruence in age and sex is due to quota sampling. Travel mode choice on work and educational trips was measured separately in Herry (2002); the first value refers to work trips, the second value refers to educational trips.

	Sample		Population	
Age, Sex				
	male	female	male	female
< 14 years	—	—	8,5%	8,1%
15–29 years	11,0%	12,0%	9,3%	9,1%
30–44 years	15,0%	16,0%	12,5%	12,3%
45–59 years	10,0%	11,0%	9,2%	9,4%
> 59 years	10,0%	15,0%	8,9%	12,7%
Highest educational level				
Basic education	13,0%		32,0%	
Vocational education	30,0%		35,2%	
Secondary and post-secondary education	29,0%		25,8%	
Tertiary education	28,0%		7,0%	
Net household income				
< €1.351	20,0%		25,0%	
€1.351 – €2.120	35,0%		25,0%	
€2.121 – €3.000	21,0%		25,0%	
> €3.000	22,0%		25,0%	
Yearly traffic performance				
Mean	15.381 km		ca. 9.000 km	
Median	12.000 km		—	
Travel mode choice—Work/education				
Mot. indiv. transport	67,5%		63,0/17,0%	
Public transport	15,7%		18,0/45,0%	
Bike	9,6%		5,0/5,0%	
Pedestrian	7,2%		13,0/33,0%	
Travel mode choice—Shopping				
Mot. indiv. transport	64,0%		48,0%	
Public transport	4,0%		9,0%	
Bike	1,0%		6,0%	
Pedestrian	31,0%		37,0%	
Travel mode choice—Leisure				
Mot. indiv. transport	78,0%		49,0%	
Public transport	6,0%		12,0%	
Bike	3,0%		5,0%	
Pedestrian	13,0%		33,0%	