D1.3 Transferability analysis: innovative sustainable urban solutions from Europe, Singapore, China and Latin America

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Contents

1. SOLUTIONS project

Transport is a key enabler of economic activity and social connectedness. While providing essential services to society and economy, transport is also an important part of the economy and it is at the core of a number of major sustainability challenges, in particular climate change, air quality, safety, energy security and resource efficiency (EC2011: Transport White Paper).

SOLUTIONS aims to support the exchange on innovative and green urban mobility solutions between cities from Europe, Asia, Latin America and the Mediterranean. The project brings together a wealth of experience and technical knowledge from international organisations, consultants, cities, and experts involved in transport issues and solutions.

The project's overall objective is to make a substantial contribution to the uptake of innovative and green urban mobility solutions across the world by facilitating dialogue and exchange, promoting successful policy, providing guidance and tailored advice to city officials, and fostering future cooperation on research, development and innovation. The project is organised into five main parts to realise the take-up of sustainable mobility solutions. An initial transferability assessment is followed by a concept of knowledge sharing and capacity building. Both form the basis for transfer, take-up and future cooperation in Asia and Latin America and transfer and future research cooperation in the Mediterranean. The results will be widely promoted through global dialogue, dissemination and outreach.

A broad range of innovate and green urban mobility solutions are covered in the project, which are organised around six thematic clusters:

- Public transport
- Transport infrastructure
- City logistics
- Integrated planning / sustainable urban mobility plans
- Network and mobility management
- Clean vehicles

2. About this document

This document is a part of Work Package 1 of the project. The main aims of the work package are to carry out a transferability analysis of SOLUTIONS innovative measures and to develop guidelines for successful implementation of these measures. The tasks included in this work package are:

- Task 1.1 Identification of innovative solutions
- Task 1.2 Transferability analysis
- Task 1.3 Transferability guidelines for implementers

This document is the outcome of Task 1.2. The first part of this document includes a transferability analysis methodology that has been produced from a desktop study of previous methodologies, which was then further improved through a review process. Within the SOLUTIONS project, this document will provide guidance to analyse success factors and barriers for transfer of the innovative solutions between the Leading Cities and the Take Up cities. This will be reported in Deliverable 3.1 Feasibility Studies. The below graph shows where the transferability analysis sits in the delivery of D3.1 Feasibility Studies.

Figure 1: Delivery of D3.1 Feasibility Studies

3. Transferability

Transport is a key enabler of economic activity and social connectedness. While providing essential services to society and economy, transport is also an important part of the economy and it is at the core of a number of major sustainability challenges, in particular climate change, air quality, safety, energy security and efficiency in the use of resources (EC2011: Transport White Paper).

Cities across the world have a need to establish sustainable transport systems, which provide efficient and safe mobility for their citizens with the minimum of environmental impact. A variety of innovative and green urban transport and mobility solutions are available and have been successfully implemented in cities in Europe or other world regions. However, at this time, the implementation of innovative urban transport and mobility measures varies widely both within European member states and globally: some cities are well advanced with leading applications, whilst others are rather less developed. To achieve more widespread implementation and harmonisation of innovation urban mobility solutions, there is a need to share best practice across and between cities worldwide.

The European Commission has recognised this. With the Urban Mobility Package, that has been adopted in the end of 2013, the EC reinforces its supporting measures in the area of urban transport by encouraging the sharing of experiences, show-casing best practices, and fostering cooperation; providing targeted financial support; focusing research and innovation on delivering solutions for urban mobility challenges; and enhancing international cooperation. The cooperation activities to support sustainable urban mobility policies will be increased in particular with developing regions. It is aimed to export European expertise and technologies that enable cities to improve their urban transport system by reducing emissions, improving energy efficiency and road safety (COM 2013 – 913).

3.1. Introduction

Most of the cities across the world have a need to establish sustainable transport systems which provide efficient and safe mobility for their citizens with the minimum of environmental impact. At this time, the implementation of innovative urban transport and mobility measures varies widely both within European member states and globally: some cities are well advanced with leading applications, whilst others are rather less developed. To achieve more widespread implementation and harmonisation of innovation urban mobility solutions, there is a need to share best practice across and between European cities – a process which requires a methodology to determine whether and how such innovative urban mobility solutions can be transferred from one place to another. Task 1.2 will provide a practical framework for assessing the transfer feasibility of sustainable urban transport solutions. This framework is presented in this report. Task 1.3 will test the transferability of identified solutions from one context to another, share experience and guide and support the implementation of innovative sustainable urban mobility solutions. These activities will be presented in D1.4 Transferability guidelines for implementers: lessons learnt from SOLUTIONS and previous initiatives on sustainable urban mobility policy and transfer

A number of studies and projects have demonstrated that no generalised assumptions can be made about the transfer of policies and operational measures. A simple comparison of cities where measures have already been implemented from origin to target cities does not address the complexity of economic, societal and political conditions, which can vary greatly from one region/ city to another. The success of policy transfer depends on the characteristics of each measure in relation to the target city. There is already a wealth of knowledge on transferability methodologies on which SOLUTIONS can build in particular from CIVITAS, NICHES+ and TIDE. SOLUTIONS summarises these methodologies and provides a practical framework for assessing the transfer feasibility, also known as transferability, of sustainable urban transport solutions.

The transfer of policy and operational measures for transport and urban development from one city to another has grown markedly over recent years. There has been substantial exchange and transfer within Europe facilitated by a number of EU-funded research projects as well as networks such as Polis and ICLEI and though international cooperation with cities around the world. This experience can provide useful insight into the process of transferring policies from Europe to other regions in the world (and the other way around). However as technological, economic, political and cultural conditions can be quite different from one country to another, approaches may need to be adapted.

Experiences has shown that many promising initiatives did not manage to achieve their full potential and in many cases did not prove to be sustainable beyond a pilot project period or over a long period of time, often due to reasons that do not have to do with the potential of the initiative in itself, but with reasons such as not being communicated and implemented properly, thus not actively involving key parties in achieving broader acceptance and being fitted properly within a broader planning framework. Furthermore, experience has shown that:

- Measures that have proven to be successful in one city may not be applicable or may not result in improved efficiencies in another city;
- Measures taken independently may not achieve their full potential;
- There is a need to understand the interactions among various measures (along with each specific context). Some measures are supporting each other; some are conditional to each other; some may deter or impede each other’s effectiveness; some measures taken together may have a multiplier effect of their impacts, others taken together may produce less than the sum of their

potential individual impact;

Conditions under which a specific measure or package of measures work must be identified and properly adjusted and adapted to local conditions. To undertake a transfer process between EU cities and cities around the world, a methodological framework has been developed in SOLUTIONS that defines the conditions for a successful transfer while identifying the limits of each transfer case (transfer barriers).

3.2. Definitions

This is an overview of the terminology used in SOLUTIONS:

Policy transfer describes the process of transferring knowledge and good practices between two political units (e.g. cities). Policy transfer studies emphasise the specific character (content) of policies and their modification throughout the transfer process. Moreover, they allocate attention to the behaviour and role of institutions and individual actors during the implementation process of a certain policy. Transferability thus heavily depends on the interplay of different stakeholders such as governments, private entities, financial institutions, NGOs or research organisations. It must be noted that policy transfer does not only include simply copying successful solutions, but also allows for the possibility to make substantial changes to the policy in question. In this respect, policy transfer may, but not necessarily has to, result in policy convergence.

A commonly used definition of policy transfer is 'a process in which knowledge about policies, administrative arrangements, institutions, etc. in one time and/or place is used in the development of policies, administrative arrangements and institutions in another time and/or place' (Dolowitz and Marsh, 1996). The applicability and potential of the identified solutions (please see 'D1.1 Working paper on innovative solutions in cities around the world' for an overview of innovative solutions) in other cities and world regions depend on the local and national **context conditions** such as socio-economic aspects, legal frameworks individual cultural aspects e.g. attitudes towards enforcement and control – what is accepted in one cultural context may not be accepted in another. Also city specific aspects are of high importance; e.g. spatial structure and land use patterns or characteristics of mobility (modal spilt etc.). It is therefore important to identify those context conditions which are key to the innovative solution's success and which must also be addressed in any new location. It is also valuable to identify those context conditions which have created barriers to success so that they can either be overcome or transfer avoided where such factors exist.

Transferability of a solution is understood as the ability or feasibility of policy transfer.

Transferability analysis is a process of assessing the feasibility of transferring a successfully implemented innovative solution from one city to another. What is best for a city is not necessarily best for the EU or the world as a whole (and vice versa) The process analyses the context conditions that influence potential implementation in the Take-up City and learning from the experiences of the Leading City[1]. The transferability analysis provides an opportunity to learn from the previous experience of implementation and to better exploit opportunities and avoid mistakes.

These are the advantages of using the transferability analysis:

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[1] Within the SOLUTIONS project Leading City refers to the city that has already implemented a policy or measure, thus acts as ‚donor' in this process, Take-up cities are the cities to which the policy or measure ist to be transferred to, thus being a ‚recipient' in the process.

- Systematic approach to innovation
- Reduces the risk of bad decision making
- Feasibility check at an early stage
- Clear definition of innovative solution – What exactly is it that we want to transfer?
- It focuses on the essence and reduces the complexity of the solution being transferred
- Comparability between different innovative solutions
- Don't have to reinvent the wheel
- Learn from the mistakes of others
- The process itself leads to stakeholder and expert involvement

3.2.1. Literature Review

A recent review of policy transfer literature in the field of transport and planning policy (Marsden & Stead 2011) showed that such study is still in its infancy. Most of the existing literature involves case study analysis, whilst this method has many advantages and conclusions can be drawn from extensive literature reviews such as that conducted by Marsden & Stead, it becomes difficult to directly compare transfer processes when what is being transferred, by whom and in what context are such variables. SOLUTIONS will contribute to this developing field transfer of transport and planning policy.

The work by Dolowitz and Marsh (1996, 2000) builds the theoretical backbone of the transferability analysis developed for SOLUTIONS. Two key lessons can be drawn from this work:

a) Policy transfer is not an all-or-nothing process: there can be different degrees of transfer- Dolowitz and Marsh (2000) distinguish between four gradations of transfer: (i) copying, which involves direct and complete transfer; (ii) emulation, which involves transfer of the ideas behind the policy or programme; (iii) combinations, which involve mixtures of several different policies and (iv) inspiration, where policy in another jurisdiction may inspire a policy change but the final outcome does not actually draw upon the original idea.

b) The underlying process in policy transfer includes a list of seven questions concerning policy transfer that help others to pinpoint attention on various aspects of the process:

1. What is transferred?

2. Why do actors engage in policy transfer?

3. Who are the key actors involved in the policy transfer process?

4. From where are lessons drawn?

5. What are different degrees of transfer?

6. What restricts or facilitates the policy transfer process?

7. How is the process of policy transfer related to policy “success” or policy “failure”?

The transferability analysis in SOLUTIONS recognises the work by Dolowitz and Marsh (1996, 2000) as the underlying framework.

Regarding transferability, in particular the decision making processes must be considered when taking up practices from other cities: In which decision making context was the original plan conceived? Whereas a long-standing tradition of public engagement exists in some countries, in others decision-making is done by elected politicians and an advisory group of experts. In some cases, national legislation may facilitate (or hinder) the implementation of certain decisions, for example the take-up of electric vehicles can be facilitated largely by tax regulations.

May et al. (2005)2 distinguished three broad approaches for the decision making process:

- In a vision-led approach, an individual political leader (such as a mayor) has a clear vision of the future form of a city and this individual pushes through the policy instrument. Due to the fact that this approach depends on an individual political leader, it is vulnerable to any political change.
- A plan-led approach involves the specification of problems and objectives and the use of formal assessment methods. This approach depends greatly on professional planners and has the risk of losing support outside the professional circle (i.e. any other stakeholder).
- A consensus-led approach involves different stakeholder groups into the discussion on any stage of development; agreements and common strategies must be reached in each stage. This may lead to delay and inactivity when agreements cannot be reached.

May et al (2005) analysed the decision-making process for 60 European cities. Of course, mixed approaches are common and a combination of plan- and consensus-led approaches is the mostly adopted decision making approach (44 percent), which is the combination of professionalism and stakeholder involvement.

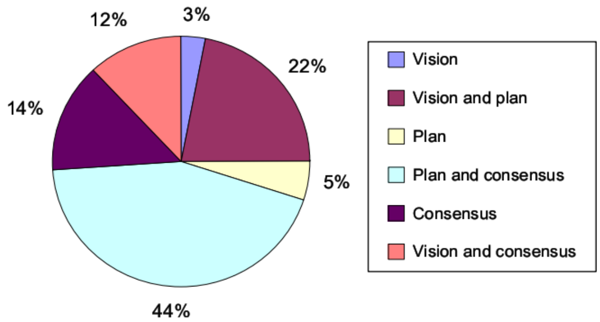

Figure 2: Decision making approaches adopted in 60 European cities

As recognised by Marsh and Sharman (2009) it is difficult to measure the effectiveness of a transferred policy and the same is true for measuring the success of the transfer itself because it results from the cumulative effect of knowledge and ideology transfer, alongside circumstances and individuals involved, over time (O'Dolan and Rye, 2012). That is to say that the impact of the transfer mechanism used within the SOLUTIONS project may only become apparent some time after the project end and even then the direct impact of them on any change in policy would be hard to quantify.

[2] May, A.D., A. Karlstrom, N. Marler, B. Matthews, H. Minken, A. Monzon, M. Page, P.C. Pfaffenbichler, S. Shepherd (2005). *Decision Maker's Guidebook*.

Whilst studies have provided insights into processes there remains much to be done to understand the benefits of policy transfer, the most effective means of looking for new policies and the conditions under which transfer works best. Within SOLUTIONS we try to progress and find new insights into the process, especially from a global perspective.

3.2.2. Policy transfer within EU projects

There is also a range of programmes, policies and projects that actively supports and promotes policy transfer through policy networks and best practice guides and databases. This is particularly true in Europe and the US, where there is a common belief that policy solutions already exist and simply need to be implemented more widely. As highlighted by Timms (2011) ‘there are increasing opportunities of EU funding for projects that facilitate professional information exchange, which clearly have an impact on transport policy transfer. The findings of two EU projects have particularly influenced the development of the SOLUTIONS transferability analysis:

- The CATALIST project which co-funded CIVITAS take-up activities between 2008 and 2012 and developed a “Guide for the Urban Transport Professional – Results and Lessons of Long-term Evaluation of the CIVITAS Initiative”.

- The TIDE (Transport Innovation Deployment in Europe) project running from 2012 until 2015, a Coordination Action funded by the European Commission’s DG Research and Innovation under the Seventh Framework Programme for Research and Development provides a specific methodology for the take-up of sustainable urban mobility measures which is building on experiences and findings of predecessor projects such as NICHES and NICHES+.

Of the transferability methodologies adopted in the above mentioned EU projects, the methodology adopted in TIDE is the most relevant to SOLUTIONS, and has been taken as the basis for the SOLUTIONS transferability methodology, described in the next chapter.

4. SOLUTIONS Transferability Analysis

SOLUTIONS provides a **methodology** to analyse the transferability and enhance the policy transfer of innovative urban mobility solutions from one city to another. The methodology is designed **to maximise the usability for practitioners** in cities around the world. It is a **systematic qualitative methodology** where stakeholders and experts **cooperatively** come to conclusions on introducing innovation into a city. This is the third step in the systematic transfer process of SOLUTIONS.

This is an overview of the terminology used in the transferability analysis:

Leading city: A city where an innovative solution is successfully implemented.

Take-up city: A city which wish to implement an innovative solution that is successfully implemented in a leading city.

Take-up coach: An organisation that will coordinate the transferability process between Leading and Take-up City.

Components: Main factors that can contribute to the success (or failure) of a measure when implementing in a city.

Sub-components: Sub-categories of the components relevant to the transferability of the measure.

Scaling (up/down): Increasing or decreasing the size of the implementation of a measure in a Take-up City (in comparison to the Leading City).

The SOLUTIONS transferability analysis methodology has seven steps as shown in Figure xxx below and described in subsequent sub-sections. The methodology has been produced from a desktop study, which was then further improved based on the input of the Transport Research Arena 2014 Invited Session *'Transport Innovation Transferability Workshop – Best Practice Examples from TIDE and SOLUTIONS'* 17th April 2014 and the SOLUTIONS Global Expert Group Meeting: 'Fostering Sustainable Urban Mobility Solutions' 23rd-25th April 2014 in Barcelona, Spain.

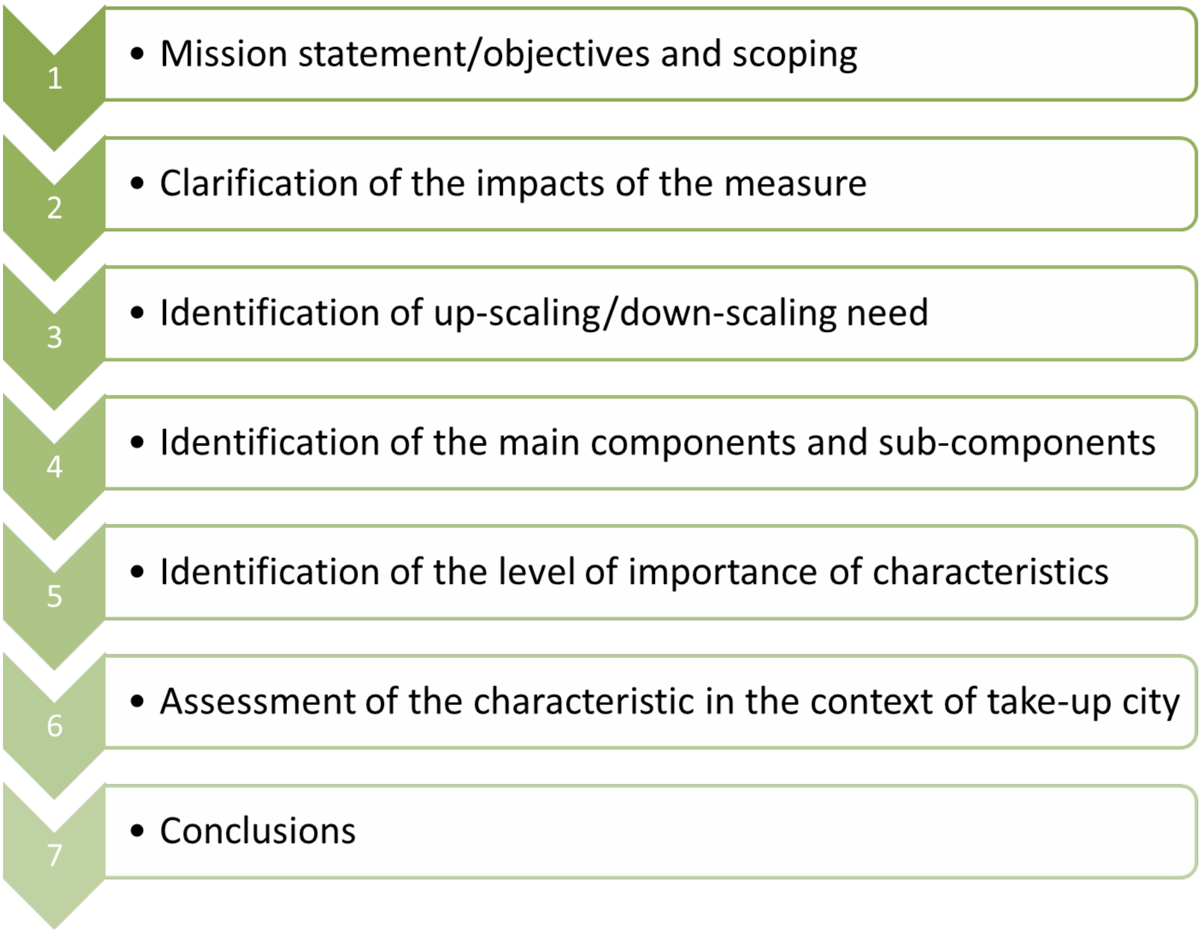

Figure 1: SOLUTIONS transferability assessment steps

Sources of information

The information required for transferability assessment of an innovative solution can be collected from various sources, depending on the component being considered. These sources include:

- Literature: The best sources of information are the available documents and literature relating to the innovative solution from the Leading City that has successfully implemented the innovative solution. Evidence may also be gathered from other sources.
- Interviews (phone/face-to-face): Interviews allows receiving information that is not readily available from published literature via contacting the Leading City. Telephone or email contact may quickly clarify many of the queries.
- Workshop: Workshops provide an opportunity to address transferability issues with input from different stakeholders. Focus Groups can be an effective approach for gathering useful information from a workshop. From the experiences of NICHES+ and TIDE, Focus Groups enabled in-depth qualitative information on innovative transport concepts to be obtained from stakeholders.
- Field visit: In some cases, site visits could be useful to gather first-hand experience of the implementation and its impacts.

STEP 1: Mission statement/objectives and scoping

A clearly defined mission statement (or clear objectives) and a realistic scope for an innovative solution are the first step of a transferability assessment. This should avoid any misunderstanding during the subsequent transferability and implementation processes. The rest of the transferability steps should only be carried out after the Take-up City understands and agrees with the objectives and scope of the measure. Dolowitz and Marsh (2000) suggest eight different categories that can be transferred: policy goals, policy content, policy instruments, policy programs, institutions, ideology, ideas and attitudes.

STEP 2: Clarification of the impacts of the measure

Identification and quantification or qualitative description of the impacts of a measure provide the essential justification and supporting evidence for consideration of the measure for implementation by the potential Take-up City. These impacts are likely to vary according to the measure being analysed for potential transferability. For example, the impacts could include changes in:

- Efficiency (capacity, journey time…);
- Safety;
- Environment (emissions, noise, visual intrusion…);
- Accessibility;
- Vehicle occupancy;
- Passenger waiting times.
- Overall impacts can be demonstrated on the basis of economic analysis or multi-criteria analysis.
- Benefit-to-cost ratio (BCR) can provide an effective way of justifying the implementation of an innovative solution in economic terms. The benefit-to-cost ratio of a project or measure can be compared to other options and/or to a 'do-nothing-scenario' to identify the most favourable option from an economic perspective (ITF, 2011). However, soft effects such as increased liveability are difficult to integrate in such an economic assessment.
- Multi-Criteria Analysis (MCA) takes into account a wider range of costs, benefits and trade-offs and can integrate also qualitative impacts. It also allows assigning different weights to various impacts in the assessment to reflect the decision makers' priorities (ITF, 2011).
- As far as possible, impacts should be quantified (e.g. level of journey time savings), supported by qualitative information where this is not possible.
-

STEP 3: Identification of up-scaling/downscaling need

It is important to determine whether scaling (up-scaling or down-scaling) of the measure is required or not. For example, if a route based measure (e.g. bus priority) is considered for application to a whole city then up-scaling is required. If this is the case, the potential implications of such scaling needs to be taken into account when carrying out subsequent transferability assessment steps. This depends on the context conditions, mainly the implementation size of the Take-up City in comparison to the Leading City.

STEP 4: Identification of the main components and sub-components

In this step, the main factors (termed here as components) that can contribute to the success (or failure) of a measure are identified so that their relevance to transferability can be assessed. These include: policy, finance, stakeholder involvement, technical requirements, demographic issues, institutional and legal frameworks, etc. These components are further broken down into sub-components relevant to transferability. For example, the characteristics of policy (component) may include: public transport policy, accessibility policy, etc. The identification of components and sub-components of a measure in the context of the transferability depends on the experience of the Leading City. A starting list of components and sub-components which can influence the transferability of a measure is given in Appendix A. The list needs to be revised and finalised on the basis of available literature or information gathered from the Leading city.

STEP 5: Identify the level of importance of the sub-components

This step requires the relative level of importance (i.e. high/medium/low) of each sub-component to be judged from the viewpoint of the Take-up City. Of course, the experience of the Leading City and advice from the experts in the field are also valuable in this process. The chosen level of importance should be supported by comments.

Step 6: Assessment of the characteristics in the context of the adopter city

This is a subjective assessment informed by the ease or difficulty experienced in implementing the measure in the Leading City. A discussion with the cities (Leading and Take-up) as well as the experts in the field is likely to be needed for this step. If the assessment is carried out in a group, an anonymous scoring approach could be effective. The assessment should be made using the scale from +2 to -2 as follows:

+2 strong support for transferability

+1 modest support for transferability

0 no support or no constraints

-1 modest constraint for transferability

-2 strong constraint for transferability

Step 7: Conclusion

The final step of the transferability assessment is to draw conclusions about the potential for transferability though consideration of the factors identified and the assessment values ascribed to each. This should include discussion of all the key success factors and key barriers for transferring the innovative solution. In addition, it should include discussion of the mitigating actions that could overcome key barriers. Based on the discussion, the concluding remarks on the chances of successful transferability should be made.

- If there are one or more strong constraints to transferability, it is likely that the innovative solution will not be transferable unless the constraining conditions can be overcome in the new area or city.
- If there are no strong constraints, but one or two modest constraints, it is still likely to be difficult to successfully transfer the measure unless the constraining conditions can be adequately addressed.

- If there are no constraints, it is likely that the measure could be successfully transferred, particularly where supporting factors can be put in place.

Assessment template

An outline transferability assessment template (Table xxx) shows the generic steps. The rest of the parameters will depend on the specific measure selected for transferability analysis.

Table xxx: Transferability assessment template

Innovative measure	

Step 1	
Mission statement/objectives and scope	
Step 2	
Impacts of the measure (depend on the measure)	*Comments, including contribution to successful implementation*
Step 3	
Up-Scaling or down-scaling required?	

Step 4		Step 5		Step 6
Components (depend on the measure)	*Characteristics of the components (depend on the measure)*	*Importance in current context*[1]	*Comments, including contribution to successful implementation*	*Likely support or constraint for transferability in the adopter city*[2]

Step 7	
Conclusions	*Comments*

[1] Importance in current context as: high / medium / low
[2] Likely support or constraint for transferability in the adopter city: support +2 to -2 constraint for transferabilit

5. Example Transferability Analysis

Two different examples of a transferability analysis are presented in this chapter that have been developed in the TIDE project. In the below cases, the transferability analysis is applied to two innovative measures without a direct focus on one take-up or leading city. The aim of this is to show the 'general' points that should be considered when transferring those measures.

5.1.1. Transferability analysis of clean city logistics

Measure description

With repeating daily routes, limited distances and frequent stops inner-city delivery and city logistics provide an ideal field of application for battery electric vehicles (BEV). The advantages of the use of BEV transporters are the reduction of local noise and the absence of local pollutants emissions. In addition to the good match between the characteristics of BEV and the requirements of city logistics, the application of electric transporters can also be combined with new logistics concepts with smaller and thus more flexible transporters, night-deliveries and access to formerly restricted areas such as pedestrian roads. Moreover, conventional big, slow and noisy conventional trucks with comparatively high emissions could be banned from entering city centres in the long run. At depots outside the city, goods could be reallocated to emission-free transporters and distributed flexibly and on demand within the city.

Mission statement (Step 1)

To support cities in enhancing the use of electric vehicles in freight delivery by shaping the context conditions. To inquire which policies and incentives can be provided to stimulate a higher use of electric freight vehicles within private logistics companies.

Scope

The scope of such applications varies from building up charging infrastructure, encouraging the purchase of vehicles and dedicated delivery zones for electric freight vehicles to the design of new policies make inner city delivery more flexible and efficient to private logistics companies.

Encouraging purchase of electric freight vehicles:

- **Dedicated delivery zones / charging infrastructure:** Creation and Cconversion of zones reserved for loading and unloading into spaces reserved for electric freight vehicles. This spaces could be equipped with charging infrastructure and a booking system which gives the companies the possibility to make reservations for a dedicated time slot

- **Inner City night-delivery:** Delivery with low noise electric freight vehicles during night time to reduce delays for logistics companies due to heavy traffic during daytime.

- **Bus Lanes:** Allowance for electric freight vehicles to travel in bus lanes, providing added benefit for logistics companies which use BEVs, particularly at peak times.

- **Congestion Charge:** Congestion charging discount for electric freight vehicles

- **Low Emission Zones:** Access to inner-city Low Emission Zones for electric vehicles

- **Urban Consolidation Centres:** Depots outside the city where goods can be reallocated to emission-free transporters and distributed flexibly and on demand within the city.

Impacts of the measure (Step 2)

The success of the Measure depends on a variety of factors. Since the distribution of the goods in inner cities is handled by private companies, the policy needs to ensure that the high entry barriers can be overcome. High acquisition costs and the outlay for the redesign of logistic concepts complicate the implementation of Battery Electric Vehicles in the logistics sector. The logistics concepts should also include an optimization of the fleet utilization and consideration of whether it makes sense to use BEVs against the background of different urban environments or a mixed-use of conventional and electric vehicles. Here, of course, the freight characteristics play a key role. The big differentiation of goods regarding size, weight and transit temperature within the logistics sector require different suitable solutions for new, innovative clean city logistics.

The development of the technological efficiency of electric vehicles also has a big impact on the implementation. A safe and comprehensive supply can be ensured only when mature technology is available. When it comes to the technology of electric vehicles the financial efficiency can't be ignored. One of the main barriers is the cost for installation and components of the charging points. Other potential aspects are safety issues and of course there has to be ensured a minimum comfort for the drivers of BEVs. This aspect is strongly related to the technology efficiency and the problem of energy supply of electric vehicles.

Table 5.1: Impacts of clean city logistics

Impacts	Description
Efficiency	Improved efficiency can result from re-optimising the fleet utilisation, using a mix of conventional and electric vehicles according to the needs of the items being carried.
Safety	There may be safety issues with BEV's (quietness, etc.) which would need to be monitored/overcome.
Environment	This should be the key beneficial impact – the reduction of local emissions, noise and fuel consumption through the use of BEV's.
Accessibility	Small BEV is appropriate to the load being carried.
Financial Efficiency	The technology used has to be affordable, the costs of installation and components of the charging point have to fit to a positive business case.
Economic impacts	A social cost-benefit analysis will reveal economic impacts.
Overall impacts	These are best shown by a multi-criteria analysis which combines both quantitative and qualitative evaluation.

Scaling need (Step 3)

Generally there is no need to for up- or down-scaling of this measure because it is mostly up to the logistics companies if and how many electric vehicles they integrate into their fleets and even in large-scale cities they will electrify only those parts of their fleets where it is feasible concerning route-distances, size of goods, topography, economic reasons etc.

Concerning the size of a possible adopter city, downscaling is only possible to a certain level of urban density. Electric Freight delivery works well for short routes with many destination addresses. These conditions are primarily given in denser urban areas of mid-sized and large cities.

Components and their characteristics (step 4)

Generally the most important components for Clean City Logistics are those which support the economic efficiency of electric freight vehicles in commercial fleets of private companies. Strong political support is needed to implement policy measures to encourage the use of EVs in goods delivery, as entry to low emission zones, the use of bus lanes, night-time delivery, discounts on congestion charges or lower taxes and therefore help to increase the fleet utilization of the companies. The goal is to compensate the high capital costs for vehicles and infrastructure with lower running costs and an increased fleet utilization.

Furthermore it is important that the logistics companies analyse the market to ensure an efficient distribution of goods with the diverse types of transportation. Therefore the market segmentation should be clear in advance. Different types of goods and their respective characteristics, such as size, weight and required transport temperature, have to be analysed.

Table 5.2: Component and characteristics of clean city logistics

Components	Characteristics	Comments
Political Support	Sustainable Urban Mobility Plans	SUMP's need to include a role for freight BEVs
Policy Measures	Congestion Charge	Charge exempted or discounted for freight BEVs
	Low Emission Zones	Access allowed for freight BEVs
	Incentives (bus lanes, dedicated parking)	Improved journey times and access for freight BEVs
Fleet utilization	Night-time delivery	Possible because of quiet propulsion
	Increased complexity in route-planning for EVs	Improved optimisation
CSR/Marketing	Eco Label	Positive image
	Stakeholder involvement	Engagement with logistics companies is needed
	Driver Training for eco-driving	
Costs	Running costs	Lower running costs will encourage implementation
	Capital costs	Encouragement needed for investment
	Charging infrastructure / grid-connection	Required also for passenger BEVs
Market analysis/characteristics	Market segmentation	Will dictate freight BEV utilisation
	Type of Goods	Will dictate freight BEV utilisation
Range	Load-capacity, max. weight/volume of BEVs	
	Range of BEVs	Key current issue
Driver	Driver comfort/safety (air condition, winter condition)	
Charging infrastructure	Capacity for substations	Will affect take-up
	Grid integration	Will affect take-up
	Strategic distribution of charging infrastructure	Will affect take-up
Advanced ICT	Monitoring of vehicles location/battery status	Needed for efficient operation of the system
	Real-time communication	Operational issues
Built environment	Street-Layout	Will affect feasibility

Components	Characteristics	Comments
	Land-uses	Will affect feasibility
Natural environment	Geography (location, topography)	

Assessment of characteristics (steps 5 and 6)

Although the topic is not the latest, there are still relatively few assessments and evaluations of projects in the field of electric mobility. There are still just a few examples which were implemented in the past couple of years and therefore experts with practical experiences and information about the goals achieved are rare.

Table 5.3: Assessment of characteristics of clean city logistics

Characteristics	Importance in the current context	Likely support or constraint for transferability in the adopter city	Comments
Sustainable Urban Mobility Plans	Low	0	
Congestion Charge	High	-2	Barrier unless exempt
Low Emission Zones	High	+1	Low emission zone support electric vehicles
Incentives (bus lanes, dedicated parking)	Medium	+1	Such incentives support implementation
Night-time delivery	High	+1	Becomes possible
Increased complexity in route-planning for EVs	Medium	0	
Eco Label	Low	+1	Support implementation
Stakeholder involvement	Medium	+2	Involvement of logistics companies support the implementation
Driver Training for eco-driving	Low	+2	
Running costs	High	+2	Lower running costs will support implementation
Capital costs	High	-1	Investment needed
Charging infrastructure / grid-connection	Low	0	
Market segmentation	High	+1	
Type of Goods	High	+1	
Load-capacity, max. weight/volume of BEVs	High	+2	
Range of BEVs	Medium	+2	Longer range will support the implementation
Driver comfort/safety (air condition, winter condition)	High	0	
Capacity for substations	High	0	
Grid integration	High	-2	Potential barrier
Strategic distribution of charging infrastructure	Medium	+1	Availability of charging infrastructure will encourage take up

Monitoring of vehicles location/battery status	Medium-High	+2	Help efficient operation of the system
Real-time communication	Medium	+2	
Street-Layout	Medium	-1	
Land-uses	Medium	-1	
Geography (location, topography)	High	-1	

Conclusions (step 7)

Key drivers for transfer

The private companies play an important role in the implementation of BEVs in the logistics sector. It is essential to create incentives which help them to run electric freight vehicles economically efficient.

Other key drivers will be increasing energy costs, more restrictions concerning emissions and noise in dense inner-city areas and raising customer-awareness.

Key barriers for transfer

The main key barrier is the high purchase price, which results from the fact that the number of units in production is still too small. While the automobile manufacturers wait for more orders, the companies hesitate to buy BEVs at today's price. In addition, considering the whole life cycle BEVs can't amortize the high purchase price with the small running and maintenance costs yet.

Besides the financial aspects, the wait-and-see attitude exists due to the smaller ranges of the BEVs than the conventional cars and the infrastructure for charging batteries is not area-wide. Therefore the route planning particularly in areas with tough natural environment remains difficult. Also the conditions for the drivers especially in winter are less comfortable than in conventional cars due to the weaker energy supply.

Taking into account all these aspects it is difficult and expensive for the city council to set incentives for the logistics companies to procure BEVs. On the side of car manufacturers there is uncertainty about the direction of development in the car industry.

Mitigating actions

An analysis of the key barriers makes it clear, that the financial risks for the both purchasing and selling side constitute the main obstacle to foster electric vehicles in the logistics industry. The problem of funding needs to be addressed with subsidies and low start-up financing schemes or brand new financing models. Another possibility is the purchase of electric vehicles in public companies to provide a successful example for the electrified transport of freight, generate demand for the car manufacturers and gain experience, which can be shared. The problem of missing technology in the field of safety and comfort can be solved with public tenders for research and development.

In conclusion it becomes clear, that public institutions have to create the (financial) incentives to address the uncertainties in this field.

Remarks

Comparing the key drivers and barriers under inclusion of the mitigating actions, it is clear that the introduction of electric vehicles in the logistics industry is certainly within the realm of possibility. Concurrently, public institutions must provide suitable incentives.

5.1.2. Transferability analysis of road user charging (RUC) in urban areas

Measure description

Road user charging (RUC) applies direct charges levied for the use of roads so as to impose the societal costs of that use. Examples of road charging are road tolls, distance or time based fees and congestion charges. RUC can be used to generate revenue and/or as a transport demand management tool. By differentiating road charging by time, place, and vehicle type, the negative externalities of traffic can be reduced. The effectiveness of road user charging is often quite substantial, and once introduced, pricing can be adjusted to the level which corresponds to an efficient use of the services. On the down-side there can be political issues, because road charges can be difficult for the public to accept, since it means paying for a service that was previously provided free. It can also give rise to unwanted distributional effects, having relatively greater impact on the low income citizens.

Mission statement (Step 1)

To implement congestion charging in urban areas to address congestion problems and their effects.

Scope

Road user charging in urban areas can be implemented in different city areas. The measure can be implemented in specific city districts (e.g. Milano) or for a whole city, e.g. Stockholm. The scope of the measure depends on its main objective, and the charge can be designed in different ways, i.e. road toll, distance based charges, congestion pricing or cordon toll.

Road tolls and distance based charges are quite common but are usually not applied to urban areas because they are more appropriate for longer distance movements. Congestion pricing is currently being applied in the European cities of London, Stockholm, Milan and Gothenburg. There are also many examples of congestion pricing outside Europe e.g. Singapore and the US.

The effectiveness of urban RUC can be substantial and once introduced the levels of pricing can be adjusted to the level which corresponds to an efficient use of the services. It also allows users to choose their adaptation mechanism. For example, those who believe it is “worth paying” for the service can continue driving; whilst those who are not willing to pay will adjust their transport patterns to the new conditions.

Impacts of the measure (Step 2)

Main impacts:

- Reduced congestion or peak spreading
- Driver of a local package of measures
- Modal shift
- A new revenue source

Other impacts

- Increased quality of urban life
- Increased environmental quality
- Negative safety impacts by modal shift towards Powered Two Wheelers
- Social and territorial redistribution
- Awareness raising
- Land use impacts
- Smoothness of payment

There are discussions regarding the possibilities of how to measure e.g. increased quality of urban life, and how it can be related to travel time, to happiness.

Table 5.4: Impacts of road user charging in urban areas

Impacts	**Description**
Efficiency (capacity, journey time, congestion etc.)	Road user charging reduces the traffic volume in the area and hence reduces journey time.
Safety	Small improvement in road safety is expected as a result of lower volumes.
Environment (emissions, noise, visual intrusion etc.)	This measure reducing the traffic volume reduces emission of harmful pollutants within the area
Accessibility	Improves the accessibility of public transport in the area
Benefit Cost Ratio (BCR) value	This is site specific but a good BCR could be achieved
Multi-Criteria Analysis (MCA) results	In general, this measure could address various objectives of a scheme (e.g. in Stockholm, all stated objective were fulfilled

Scaling need (Step 3)

Regardless of the size of a city, any transfer of the measure must be adapted and scaled for the specific city and its local conditions. It is simpler to predict effects in a smaller city than in large cities where the problems are more spread and therefore are more unpredictable. The fees must be based on the local conditions for a relevant level of charging. Important input when the measure should be transferred is that when a functional system has 30 control points, it should be possible to transfer it to another city and only have 10 control points.

Components and their characteristics (step 4)

In this step, the main factors (termed here as components) that can contribute to the success (or failure) of a measure are identified so that their relevance or necessity concerning transferability can be assessed. The table was developed during workshops and is based on discussions among experts. Sources of the information used in the process included the Curacao State of Art Report (Curacao, 2008) and background information regarding the Stockholm Trial.

Table 5.5: Component and characteristics of road user charging in urban areas

Components	**Characteristics**	**Comments**
Strategies and policies	Pollution reduction policy	This can be a main objective (e.g. as in Stockholm)
	Public transport improvement policy	This can be a main objective (e.g. as in Stockholm)
	Congestion reduction	Congestion reduction very important both for policy makers and public acceptance
	Regional economy	Fear of negative consequences for retail and business can affect acceptability, but usually unfounded (e.g. London)
	Innovation policy	This is site-specific. (e.g. it was not important in Stockholm, but may become more important with the application of other, more innovative, technologies
	Sustainability policy	Road user charging is seen as a measure for increasing sustainability of transport
Target population	Affected car drivers	Shorter travel times but higher travel costs
	Commercial traffic	Dependent on short and reliable travel times: Generally positive to charging
	Inhabitants within the zone	Will benefit from less disturbances from traffic and improved air quality. They may have exemptions from the charge
	Previous PT users	More passengers - risk of overcrowding
Geographical area covered	Size of zone	Advantage if problems are concentrated to a zone of manageable size

	Network design	In dense networks there is a risk of re-routing with adverse effects on congestion
Finances	Capital costs of design, planning, implementation	High costs compared to other Traffic and Mobility management strategies
	Running costs	Similar to other traffic control systems and covered by revenue
	Revenues	To generate a new stream of revenues is often one of the main objectives for introducing charging
	Economic benefits	Increased benefits due to travel time savings and improved travel time reliability, reduced pollution, etc.
Human resources	Staff numbers required	Small effect compared to investment and operational costs
	Skills and training required	High demands on knowledge and experience for development
Stakeholders involvement	Public transport operators involved	Public transport operators may need to increase traffic to cater for increase in ridership
	Government (national)	In most cases involvement from national government will be necessary (legal requirements)
	Government (regional)	Depending on commuting patterns, effects will occur on a regional level. Therefore regional cooperation and regional distribution of benefits will be necessary
	Government (local)	They are the body affected directly
Legal or contractual requirements	Tendering of technology and roadside equipment	Complicated processes with high risk for legal contest
	Legislation	Legislation may have to be modified concerning: right to charge on existing infrastructure, identification of vehicles and persons, enforcement
Organisational or institutional aspects	Administrative structure	New organisation need to be established
	Customer services	Has to be established
Technical requirements	Equipment, Tools and software	Large investments in technological equipment and software necessary
	Information/data	Measure requires the establishment of a back-office for data analysis

Implementation aspects	Privacy	Privacy issues may become central for acceptability
Awareness and Communication	Publicity and public relations	Policy and objectives has to be communicated and marketed
	Citizens involvement	Can be crucial if a referendum is involved
	User communication	Central for understanding for how to use the system
Demographic issues	Income distribution	Equity issues often central for political acceptability
Wider issues	Topology	Natural barriers makes zone systems more feasible
	Political	Political support is necessary for a scheme
	Public acceptance	General population will most often be negative prior to implementation but improve later
	Technology risk	Now off-the-shelf proven technology for cordon based systems. GPS systems higher risk

Assessment of characteristics (steps 5 and 6)

Discussion of measure related issues were held during workshops where different actors and experts participated. The remarks made during the workshops were that the participants had very distinctive experiences. The participants' individual ratings were therefore summed up as a mean value.

Table 5.6: Assessment of characteristics of road user charging in urban areas

Characteristics	Importance in the current context	Likely support or constraint for transferability in the adopter city	Comments
Pollution reduction policy	High	+2	A key benefit of RUC
Public transport policy	Medium	+1	RUC requires good public transport and can contribute to its improvement
Congestion reduction	High	+2	The key objective of RUC
Regional economy	Medium	+1/-1	Impact rather unpredictable
Sustainability policy	High	+2	A key benefit of RUC – less private traffic
Innovation policy	Low	+1	

Affected car drivers	High	-1	Increased cost – but improved traffic conditions
Commercial traffic	Medium	+1	
Inhabitants in the zone	Medium	+1	Better environment
Previous PT users	Medium	0/-1	
Size of zone	Low	0	Depends on natural topology
Network design	Low	0	Depends on natural topology
Capital costs of design, planning, implementation	High	-2	Can be a key barrier to implementation
Running costs	Medium	-1	Depends on the technology used
Revenues	High	+2	A key driver for RUC
Economic benefits	Medium	+1/+2	Improved traffic operations and environment
Staff numbers required	Low	0/-1	Operational/enforcement costs
Skills and training required	Medium	-1	
Administrative support	Low	0/-1	
Public transport operators involved	High	-1	Need extra capacity to cater increased ridership
Government (national)	High	+/-	Depends on policy
Government (regional)	High	+/-	Depends on policy
Government (local)	High	+/-	Depends on policy
Tendering of technology and roadside equipment	High	-1	Complicated process
Legislation	High	-1	New legislation needed
Administrative structure	Medium	-1	New administration needed
Customer services	Medium	0	
Equipment, Tools	High	-2	Charging mechanism needed

Information/data	Medium	-1	
Privacy	High	-1	Can be ‘solved’ with encryption
Publicity and public relations	Low	0	
User communication	Medium	+1	If properly performed
Income distribution	Medium	-1	Can be socially divisive
Topology	Medium	-1	
Political	High	-1	Political support could be difficult
Public acceptance	High	-1	Less problematic now than in the first generation implementation
Technology risk	Medium	-1	

Conclusions (step 7)

Key drivers for transfer

Key drivers for implementing road user charging are existing problems in the city such as: traffic congestion, noise, bad air quality, etc. Another key driver can be a need for financing infrastructural investments such as new roads or improvements in the public transport system

Key barriers for transfer

There are different key barriers for transferring the measure including: the scale of congestion problems, the quality of public transport, political acceptance, etc. The congestion problems in the specific city or area have to be large enough to motivate measures requiring high investment and operational costs. Other issues can be privacy, equity and public acceptance.

Mitigating actions

There may be some down sides due to implementation of the road user charging measure. Mitigating actions are important since it can be difficult to get public acceptance when implementing especially congestion charges in a city. Mitigating actions such as information campaigns can be one way of handling low acceptance among citizens. Information of what the collected charges will fund is one good example of what these information campaigns can consist of.

It is also important to have in mind that road user charging can have a negative impact on different geographical areas and their development. By this, a certain group or community in a city may be unfairly treated and compensatory measures may be needed to mitigate this. The rule of multiple passages in Gothenburg, where vehicles passing more than one control point within one hour will only be charged once, is an example of a mitigating action. Another mitigating action can be to provide the same standard for the travelers in the public transport system as it was before implementation of the road user charges.

Remarks

Generally, road user charging in urban areas is an effective measure. The measure has high transferability potential, but it is important to consider local conditions for securing the potential of transferability.

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Appendix A

The table below gives a starting list of components and sub-components which can influence the transferability of a measure. The table is neither full nor completely necessary for all measures considered for a transferability assessment. The list needs to be revised and finalised on the basis of available literature or information gathered from the Leading City.

In the table, components are the main factors that can contribute to the success (or failure) of a measure are identified so that their relevance to transferability can be assessed. These include: policy, finance, stakeholder involvement, technical requirements, demographic issues, institutional and legal frameworks, etc.. These components are further broken down into sub-components relevant to transferability.

Tabelle 1: List of components and sub-components related to transferability of a measure

Components	Characteristics of the components
Strategies and policies	Pollution reduction policy
	Public transport policy
	Congestion reduction strategy
	Accessibility policy
	Regional economy
	Traffic management policy
	Land use policy
	Sustainability policy
	Innovation policy
	Cycling policy
	Cycle parking strategy
	Urban planning policy
	Parking policy
	Efficiency improvement policy
	Private sector participation policy
Target population	General population
	PT users
	Car drivers
	Cyclists
	Pedestrians
	Commercial traffic
	Inhabitants within the zone
	Local business
	Specific users (e.g. Elderly and disabled people, children)
Geographical issues	Route
	City area/size of implementation
	Street topology
	Climate
Finances	Capital costs (design, planning, implementation)
	Running costs
	Whole life costs
	Revenues
	Economic benefits
Stakeholders involvement	Urban Traffic manager/controller
	Public transport operators involved
	Transport authority

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	Government (national)
	Government (regional)
	Government (local)
	Cycling associations
	Motoring organisations
	Local residents
	Local business
	Police
	Trade union (e.g. Driver's union)
	Decision makers
	Advisory board
	Third party (e.g. 3rd party apps developer)
	Users
Legal or contractual requirements	Tendering process
	Legislation/ procurement law
	Efficient enforcement
	Account auditing
	Personal data protection/privacy
	Partnership agreements
	Licenses required
	Contracts
Organisational or management aspects	Administrative structure/support
	Customer service
	Relation to private operator
	Supervision structure
	Procedures
	Staff numbers required
	Skills and training required
Technical requirements	Equipment and Tools
	Information/data
	Software
	Communication technology
	Payment technology
	Audit tool (for implementation)
	Design guide
Infrastructure requirements	Substations capacity
	Distribution of charging infrastructure
	Fleet requirement
	Existing infrastructure (e.g. UTC system)
	Bus depot facility
	Space availability (e.g. cycle lane, parking)
Built environment	Street layout/ Street hierarchy
	Road network/ Density
	Land use
	Aesthetics, streetscape
Implementation & awareness aspects	Security
	Contract timeline
	Public acceptance
	Marketing
	Police support
	Political support
	Publicity and public relations
	Citizens involvement
	User communication
Demographic issues	Male/female involvement

Wider issues	Age distribution
	Income distribution
	Culture / lifestyle
	Technology risk
	Safety