1st International Conference on Project Economic Evaluation
ICOPEV'2011, Guimarães, Portugal

A COST-BENEFIT ANALYSIS OF AN INTELLIGENCE AND DEMAND-RESPONSIVE PUBLIC TRANSPORT SYSTEM FOR ELDERLY AND DISABLED

Joaquim Vítor Oliveira,* José Telhada and Paula Ferreira

Department of Industrial Engineering, University of Minho, Portugal

* Corresponding author: engvitor@gmail.com, University of Minho, 4710-057 Braga, Portugal

KEYWORDS
Transport demand for people with reduced mobility, Externality, Cost-Benefit analysis

ABSTRACT

The current road public transport systems in Portugal are not suitable for most of its inhabitants, in particular those who suffer of reduced mobility. This inadequacy is mainly due to the lack of flexibility of the transport services provided and the poor level of physical accessibility (pathways and in-vehicle facilities). This study aims to estimate the effects of the implementation of public transportation systems designed to meet the specific market of public transport demand of people with reduced mobility (e.g. elderly and disable). The main factors affecting the system must be translated into a number of criteria and indicators to be included in the evaluation of potential transportation projects in this area. The study is based on a literature review and focuses on the analysis of externalities and decision making about public transport. From this review it is intended to develop an analysis of the externalities of the projects. It will be also discussed the cost-benefit analysis for the project aimed at ensuring the sustainability of a transport demand for people with reduced mobility (TDPRM).

INTRODUCTION

The current collective passenger transport by road in Portugal is not adequately equipped with support equipment for transporting persons with reduced mobility. Furthermore, the typology of services provided is not suitable for this purpose, because these services are based on fixed-schedule and fixed-route routines that have been designed to couple general public demand.

On the other hand, public transport demand for people with reduced mobility is far from being negligible, and tends to increase as population is aging and individuals are increasingly aware of their social rights. Therefore, it urges to develop adequate transportation systems to satisfy their needs. These systems are not necessarily more costly than private car usage. In a case study carried out by Jakob et al (2006), it was found that the direct cost of using private transport is higher than the public transportation cost, even when added the indirect cost. These points to the clear benefit from using public transport to the detriment of private transport.

The public passenger transport is undoubtedly a driver for promoting the social inclusion, but it is also a right. A society that does not respect these two principles excludes its own citizens as well as their contribution to society itself.

Many citizens with reduced mobility are seniors and it is predictable that their number continues to rise. The increase in longevity and medical advances allow the elderly a better quality of life. Persons with disabilities are another group that has reduced mobility. Also here, the inclusion has not evolved only by the desire they have to contribute to society, but mainly by the change in mindset of society towards them.

The main objective of this study is to analyze the externalities of urban passenger transport for people with reduced mobility. The study will take into account the externalities that are typical of traditional public transport, but also the externalities that are inherent to the development of a transportation system specifically designed for people with reduced mobility. The benefits of the transport of persons with reduced mobility in a specific system are not due just for the simple fact mobility for everyone is ensured, but represent also a range of benefits for the society as a whole.

The paper is structured is structured as follows. Section 2 discusses the concept of externality in the context of a general transit system. Section 3 focuses on cost-benefit analysis in making strategic decisions applied to conventional public transport. Then, Section 4 presents the characteristics of a TDPRM project for urban areas. Section 5 discusses the criteria that must be considered

in the analysis of externalities related to that project. Section 6 presents the costs and benefits to be included in future analysis of the project. Finally, Section 7 reports the key findings of this research that are relevant to decision-making.

EXTERNALITIES IN TRANSPORT SYSTEMS

Definition and the case for internalisation

The development of any activity may have economic impact on others. When this impact unintentionally generate costs or benefits, then such an impact is designated as externality. The damage caused is mostly not integrated in the price system (ExternE, 2010). Also, this damage is not reflected in the products sold or the price system due to be resources where it is not possible for achieving maximum efficiency (Bin & Xinjie, 2009). Whenever the impacts bring some benefits, they are usually called by positive externalities; on contrast, negative externalities are associated with costs. In this paper, the internalisation of externalities is discussed for the purpose exposed by ExternE (2010): "This internalisation of external costs is intended as a strategy to rebalance the social and environmental dimension with the purely economic one, accordingly leading to greater environmental sustainability."

Externalities

Transport systems have a significant contribution in the development of any society. They are also the cause of a significant set of positive and negative externalities; few other human systems probably have an equal or higher impact on society in terms of externalities. Transportation externalities have been recognized, but are hardly accounted for, because this does not have a direct impact on the transport itself. Negative externalities are the most cited, not only by their direct impacts on people's lives, but also by the easiness of recognizing them. The most common negative externalities of transport are traffic congestion, accidents, greenhouse gas emissions or environmental pollution and noise.

(Zhu at al, 2008) consider that congestion has become the limiter factor in the activity and the development the economy of cities, also affecting the development of sustainable cities. The stress that people acquire due to congestion can directly affect the income in their work, as well as the relationship between co-workers, family and even customers themselves.

Road transport represents a significant share of emissions of greenhouse gases, particularly CO_2. The result is a potential climate change problem that has led to a political consensus of principal world leaders, in order to implement some actions that are required to reduce these emissions. The costs of prevention could be lower than the costs that result from climate change. (Bin and Xinjie, 2009) believe that environmental damage and environmental pollution is one of the most common and serious problems associated with transport-related externalities.

The release of gases from vehicles not only affects the environment in what concerns the greenhouse gas effect, but also generates a significant increase in air pollution, with negative impacts on the health of human beings (Bin and Xinjie, 2009).

Urban areas are the places where the effects of pollution are mostly felt, mainly due to the concentration of a high number of vehicles in a limited space. Air quality, noise pollution, vehicular traffic and public transportation availability and accessibility are becoming important factors to consider when ones choose where to live. Therefore, these factors have a direct impact on the local economy.

The policy measures for cost reduction tails on the greenhouse gas effect and even on the control of air pollution has a greater effect when applied on transport compared with other sectors (Van Dender, 2009). (Van Dender, 2009) supports that energy policies should delineate more ambitious goals on a large scale, and promote the development and use of alternative technologies, mainly through more efficient use of vehicles and/or use of alternative fuels.

Ambitious objectives probably can only be met at a reasonable cost. However, because uncertainties are high (e.g, in the true effects that negative externalities will have on the environment; in economical evolution), it has been observed many efforts to develop alternative technologies and to bring them to the market. High fuel prices through higher prices before tax are a major incentive in this context (Van Dender, 2009).

Public transport companies may need to have access to lower prices of fuel, so that fickleness in fuel price will not reflect in the price of transportation paid by users. Such type of measures can persuade people to switch from private transport to public transport, thus inducing a better urban environment and quality of life.

A large fraction of noise that exists in urban areas is due to movement of vehicles and the intrinsic characteristics of those. (Bin and Xinjie, 2009) consider that the vehicle speed, vehicle type, the type of tires, and the

condition of the vehicles are the main factors that are responsible for the emission of noise. Beyond these factors, the authors also report stress factors, such as age of the vehicle, the track gradient, surface type, and driving behaviour, which also contribute to noise pollution.

Accidents are also an important externality in transportation. The greater the number of vehicle travelling, the greater is the probability of occurring accidents. There is always a cost regardless of the accident according the damage they can cause. Accidents can result only in traffic congestion, or they can be extremely serious, as in the case of death or disability of the occupants, resulting therefore, in this case, in a high cost to society.

COST-BENEFIT ANALYSIS OF PUBLIC TRANSPORT

The cost-benefit analysis should be an important factor when making strategic decisions. When it comes to transportation, the decision should not be the simple analysis of economic-financial viability, because the final decision will directly affect people's mobility, road safety, health - due to pollution, the environment and economic development region.

The cost-benefit analysis is a method widely accepted and used by decision makers, advising on specific criteria to be taken into account in decision making and ensuring that the benefits to society outweigh the overall costs. Therefore, any investment project, mainly in the public sector, must be accompanied by a cost-benefit analysis in order to enable the evaluation of the project (Nickel et al., 2009). Beyond the economic variable easily accounted for, it is important to account for non-economic variables, such as noise, accidents and air pollution, among others. This has been the biggest problem for the application of the method (Tudela et al., 2006) due to the complexity and subjectivity of transforming these variables in monetary value, because it has not an established market and each person can assign a different value. The estimated value for these variables should address the different factors of a more global point of view. Each factor may be in more than one variable, but should be counted only once, to enable a proper analysis.

The cost-benefit analysis is used by decision makers as a way to justify their decisions or even to make that decision. However, the method of cost-benefit analysis is not the only method to be used for decision making or evaluation of a project. Through the application of different methods on the problem, different results can arise. So, the key issue is that of identifying the problem and its main features. This can be a key factor for the correct choice of method. Here too, there is some subjectivity in the choice of method and that is the decision makers' responsibility.

(Nickel et al., 2009) use the method of cost-benefit analysis and the method of Multi-Attribute Tradespace Exploration (MATE), developed by MIT (Massachusetts Institute of Technology), to assess projects. The paper presents the case study "airportexpress" to the city of Chicago and the case of high-speed railway line from Lisbon. The underlying idea of the MATE method consists on perceiving the values of stakeholders and thus creating decision metrics, by assigning a high importance to the key factor. This method aims at improving the expectations, given to interested parties. The methods used are different, but they should be used complementary for a better decision making.

The cost-effectiveness analysis allows evaluating the efficiencies of different projects, comparing them, and making the decision based on the best efficiency. The cost-effectiveness analysis allows to assess the effectiveness of a given technology, program or policy. According to its effectiveness, a measure can be defined in terms of its degree by which the objective and/or goals are achieved (Browne and Ryan, 2010). This method assumes that the costs and direct benefits can be estimated (quantified) in monetary values. The objective is to select the project with greater profit (the difference between benefits and costs).

The *Multi-criteria decision analysis* is also addressed for project evaluation (Browne & Ryan, 2010) as a way to make the decision on choosing the best project. The method transforms the option on a scale or matrix to assess the impacts comprehensively. The options involve determining the alternatives, comparison criteria, assigning weights to each criterion and definition of ranking of satisfaction.

By turn, Tudela et al. (2006) suggest a multi-criteria technique called Analytic Hierarchy Process, which consists of assigning weights that reflect the importance in the hierarchy. A hierarchy consists of separating the different attributes and alternatives, and thus assign criteria according to the hierarchy. In the end, the selection of project results from the best compromise.

Whichever method is chosen, the goal is to select the best perceived overall decision, taking into account every aspect of the project, but also the impact this will cause.

In general, a transportation cost-benefit analysis should consider the costs and benefits, and within these, the

focus must be on economic, environmental and social issues. The gain in travel time, reduced fuel expenditure and reduced waiting time at stops, among many others, are examples of economic benefits. Improving access to transport, mobility, social inclusion, sustainable development, are examples of social benefits.

In terms of economic costs, the list of factors includes the initial investment, maintenance costs, operational management and structure, congestion, etc. In terms of social costs, it can be highlighted the diseases caused by exhaust gases, noise and accidents. As environmental costs, the most important are the greenhouse effect and the release of other pollutant, which cause degradation or even destruction of fauna and flora.

TDPRM IN URBAN ENVIRONMENTS

The transport request arises in order to remedy the inadequacy of conventional public transit passenger who does not respond efficiently to lack of demand in areas of low population. The transport request is a service directed for customers, i.e., an only vehicle shifts to a stop, if there is one or more client to enter, exit or both, in that place. Thus, the service's main features are the absence of timetables and routes pre-defined, using small and medium size vehicles, according to demand.

In urban areas, the demand for public passenger transport is usually high, but there is a market in the urban areas in Portugal that public transport is unable to cover. The conventional public transport is unable to do transport or often tries to avoid it, in the case of people with reduced mobility. In this context, it is justified to develop an alternative system, flexible in terms of schedules, stops and routes, and adequately equipped for people with reduced mobility, in order to be effective and efficient, but also financially viable.

Characterization of the project

As referred before, the number of people with reduced mobility has been increasing over the years and prospects are that this will continue to happen. There are some factors that lead to it, such as greater longevity of people, regular physical activity that allows you to have a healthy life, better health care ensures a healthy life and allows disease prevention. But personal mobility naturally decreases with aging, as well as the ability to overcome obstacles, and these factors greatly limit access to public transport.

A measure used by passengers of public transport to classify them in relation to its efficiency is, with out any doubt, that transport has the ability to meet its own timetables. In what concerns the schedules, a certain pressure for the different elements of the system to make it happen exists. This has direct implications on the people who take a little longer to get on or off transport, a clear example of people with reduced mobility. On the other hand, most of the vehicles do not have adequate structures to facilitate the access of those people. Therefore, for them, there is a general lack of accessibility to transport means and, as a consequence, lack of accessibility to many services, which leads, at some extent, to a functional social exclusion.

Given this situation, a person with reduced mobility does not have an efficient public transport service for its transportation. The transport request applied to the urban environment can be addressed and evaluated as a possible solution because of the flexibility in terms of route. The time taken for boarding or landing may be less compared to a conventional transport, but the client itself can also set how long he/she needs to boarding or landing. Also the characteristics of the vehicles are suitable for this type of passenger. Bu using a heterogeneous fleet of vehicles (of small and medium dimensions), drop-on and off points do not need to be bus stops, but only a single set point between the customer and the central, in many cases can be at the customer's door. In this way, the system also avoids the outline of physical barriers that turns difficult or even impossible the mobility of users.

TDPRM CRITERIA TO CONSIDER

A TDPRM project may not be financially viable by itself in light of the private traditional perspective. There are however some parameters that must be thought out and considered the act of decision making , especially by public entities involved in the project , and who can demonstrate the social desirability of the project . The externalities of the project can justify its implementation in a wider perspective, due to the positive impact that this may have on society.

Mobility is a right recognized by all, but it is also true that this is not always the case. In reality, it is difficult to find a public transport system for people with reduced mobility at an affordable price. Most current public transport is unable to transport these people. Some people with physical disabilities also have great difficulty in walking with an additional problem, in many cases, that is equipment the need for its locomotion. The absence of public transport able to guarantee the mobility of these people causes them to

turn to a more expensive solution to ensure minimal individual autonomy.

Also accessibility to some stops or walk on sidewalks sometimes is extremely difficult. A door to door service is more adjusted to allow the client to avoid a set of barriers that constraints their movement. In addition, access to some points is difficult, if not impossible, due to lack of suitable ways, the existence of physical barriers, lack of civic responsibility on the part of others people, the physical and emotional difficulties on the part of individuals with limited movement.

In general, older people do not suffer from reduced mobility only, but also they tend to suffer from other health difficulties such as sight or hearing. Therefore, public transport tends to be even more unsuitable to accomplish their real needs. In many cases, those people opt to use their own private vehicle. Here arises a problem related to road safety due to reduced natural senses by the elderly, which leads to increased likelihood of suffering or even cause an accident. Traditional public transport simply tries to accomplish their schedules and routes, and any incident that occurs along the route has a direct influence on the person who uses this transport. For example, a small delay can have a great consequence, principally when there are transfers. A loss of transhipment may cause delays of hours at the final destination and therefore the existence of costs (working hours, loss of consulting or classes, etc.). In this sense, people with mobility problems are "motivated" to not to use these mean of transport, by which the existence of an alternative transport system, there will be room for improvement in efficiency of public transport passengers.

In essence, the transport request also requires an efficient planning. Since the system is centered on flexibility, requires a daily planning. The efficiency will be reflected in a reduction of the negative effects that are associated with transportation and its costs. The cost reduction enables greater financial viability, since the customer must pay a value very close to that it is paid for a conventional public transport service.

The service provided will increase the supply of public transport, with the advantage of being more flexible, and remains a service supplied at an affordable price for all, thus contributing to greater social inclusion.

Traffic is a major problem in urban areas, but this can be reduced if people opt for collective public transport to the detriment of private car. An increased use of public transport is reflected in urban traffic: for the greater utilization of public collective transport, the lower the utilization of private transport, causing a reduction in traffic and a consequent reduction in congestion. With this reduction, the negative effects associated with congestion are also reduced.

The specialized transportation for people with reduced mobility will also benefit their direct family members since. In certain situations, family members will no longer need to accompany or to transport the person. Thus, the family members will not have to miss their work, and companies can be better off in an indirect way, since they do not need to make changes in the management of human resources.

With some frequency, some people fail to do certain medical treatment due to not having suitable transport or to being too expensive for their economic possibilities, or to needing assistance equipment for moving. The absence of treatment may have serious consequences for patients, but with the worsening of the disease higher costs both for patients and for the health unit will be incurred. With the worsening of the disease, those responsible are "obliged" to ensure that patients are under treatment, but it is necessary to determine their hospitalization, which increases the costs of the NHS. In addition, it cannot be neglected the pain that each patient feels: this cannot be quantified in terms of cost, but has a direct impact on treatment costs and quality of life of patients and their relatives.

Currently, the transport market that is directed to senior people is still very small, but it is expected that it will increase with the longevity of the people. The demand can grow significantly and as so this market is also expected to grow. Similarly the demand for public transport appropriate to the condition of the senior will also increase, but they will look for system that provides flexibility in terms of schedules and route.

The solitude of seniors is an increasingly requirement of our society. This reality added to their difficulty or lack of mobility, makes these questions (solitude and social exclusion) even more accentuate.

Now days, in this area, worldwide targets are ambitious but fundamental. They aim to increase road safety, reducing the percentage of road fatalities, reducing levels of congestion and air pollution resulting from road traffic, public transport should be like a bet on the direction to achieve these same goals. Alternative transport systems, targeting a more specific market, including elderly and disable, have been encouraged by different governments.

Public transport collectively should not be looked only by the financial perspective, but mainly from a social point of view. The importance of public transportation for the welfare of people and the environment are factors that are increasing in people's minds. Therefore this stresses the importance of alternative systems,

towards to increase the efficiency of public transport as a whole.

In short, the demand TDPRM ensure mobility, especially for people who have limited mobility and proved at least an alternative in terms of transport and with suitable prices. Structure of vehicles should be more adequate to serve the different classes of people. Road barriers must be eliminated or reduced in order to banner the physical and psychological mobility of people.

With the reduction of capacity in normal older people, raises the issue of road safety, but also which is the contribution to increasing congestion.

The implementation of an alternative system to transport people with reduced mobility, allows public transport to be more effective in their journeys and avoid problems with delays.

The efficient planning allows optimal distance and occupancy rates, beyond meeting the real needs of customers. The competence of the staff allows people to not require more accompanying (e.g relatives).

ANALYSIS OF THE PROJECT TDPRM IN URBAN AREA

The TDPRM may not be fully self-sustaining from economical-Financial point of view, if presenting an acceptable price for everyone especially for the most socially disadvantaged groups. However the impact that this system will have for society as a whole will be able to justify its implementation. The possibility of using the cost-benefit analysis applied to a system of collective public transport passenger for people with reduced mobility will be now explored. , The main factors to consider in evaluating the project will be described, aimed at being able to justify the possible support by the public agency.

For the cost-benefit analysis of this project some factors that coincide with the conventional public transit passenger must be considered. Thus, some externalities are common to both systems but there is however a number of other that are important to consider, in particular when the project is analysed in social terms.

The analysis may consider costs and benefits directly and indirectly. The direct costs or benefits result from the implementation of the project. While the indirect effect (cost or benefit) is related to the third ones, for example the reduction of disease caused by pollutants released by vehicles, the benefit is directly related to the greater mobility of the driver, but the pollutants released by the vehicles have impact on others causing them breathing problems, for example.

In order to understand the cost-benefit analysis, we enumerate a group of factors that should be considered in the analysis. These are grouped by the direct benefits, direct costs, and indirect benefits and indirect costs.

Direct benefits:

1. Reduction of obstacles. The system should be a shuttle service, door to door, that is, the picking or delivery of persons occurs on site most appropriate for their objectives. The service allows people to walk as little as possible while avoiding obstacles and barriers that are common on the road and a lot of time prohibitive to their mobility.
2. Suitability of vehicle physical conditions of the people. The characteristic of the vehicle allows people to drop-in more easily because it has a mechanism for facilitating access, for example board lift or ramp access to the interior for wheelchairs.
3. Providence of a specialized service. People who practice the services should have sufficient training to understand and deal with the people concerned.
4. Creation of workstation, both direct (employee of the company) and indirect (to provide training).
5. Availability in terms of both schedules both for to perform as for to request, so the service goes against the real needs of customers.
6. Improved mobility of persons with reduced mobility. These people tend to be safeguarded at home to avoid a set of obstacles, thus excluding themselves from society, but the service can be viewed with greater mobility since it is a door to door service to avoiding the obstacle and thus contributing to the inclusion social.
7. Market development for senior.
8. Promotion of autonomy people who have limited mobility.
9. Reduction of consumption fuel. Particularly important, in comparison with other means of transport due to use public transport rather than the individual.
10. Lower costs on future treatment and hospitalization related with the absence of treatment at present due to lack of ability to walk.

Direct Costs:

1. Initial Investment.
2. Cost of maintenance and operations management.
3. Disclosure.

Indirect benefits:

1. Reduced travel time for passengers of conventional public transport. People with reduced mobility no longer will need to embark, reducing so any delays in the paths.
2. Improved transportation system. The reduction of traffic and of congestion as it is a public transport service. Also of public transport gains due to the absence of people with reduced mobility that would be using another system and thus the public transport has better control over stop time.
3. Increased capacity of intermodal integration.
4. Improved quality of life in urban areas.
5. Recognition as a promoter of equality for all elements of society.
6. Reducing the release of polluting gases into the atmosphere. Decreasing:
    a. The outbreak disease caused by greenhouse gases.
    b. Disturbance or destruction of fauna or flora.
7. Reducing emissions of gases that increase the greenhouse effect.
8. Reduced loss of transhipment or delays in arrival at destination of passengers on public transport conventional due to loss of time caused by the people with reduced mobility.

Indirect cost:

1. Reduction of services that could be made by other systems. It is relevant to highlight that the loss of service that was provided by other entities such examples are the taxi drivers or firefighters, so this professionals would be without a large share of its revenue.
2. The absence of determined treatment usually involves an increase in the patient's pain, which can cause anxiety in the family and people closest.

The attribution or the determinations of monetary values to the different factors become important in decision making and for choosing a project in respect of others. The comparison taking into account the intangible factors usually makes the decision more fair, contributed equally to the benefit of society as a whole.

CONCLUSIONS AND FURTHER RESEARCH

The current collective passenger transport by road is not suitable to transport people with reduced mobility. In this sense, there is a need to develop a parallel market that can fill this gap. The problem arises because of the need to ensure the financial viability of the project, so that it can be difficult in the case of the present fare aiming to provide a system relatively accessible to your target market.

The decision to implement a project aimed to accomplish this objective should not be confined to the economic analysis, but should go a bit further, in order to well justify the support by the public agency. In the theoretical analysis of externalities, it is possible to see that there are important factors that are not accounted monetarily, but must be considered at time of evaluation. These factors have direct impact on society and are not transferred in a direct manner to the project.

The main problem lies in the initial cost, but there is also a high the number of direct and indirect benefits that must be accounted for. The impact that the project has on society and the environment must be considered and analyzable so as to be supported by the public institutions.

ACKNOWLEDGEMENTS

This work was supported by the Portuguese Science and Technology Foundation through the Research PTDC/TRA/72871/2006 and by the Algoritmi Research Center of the University of Minho.

We thank the anonymous referees for their constructive comments, which led to a clearer presentation of the material.

REFERENCES

Ahmed, Q.; H. Lu and S. Ye 2008. "Urban transportation and equity: A case study of Beijing and Karachi." *Transportation Research Part A: Policy and Practice*, *42*(1), 125-139.

Bin, Z., and Z. Xinjie 2009. "Study on Environmental Externality Cost of Road Traffic". *2009 International*

Conference on Environmental Science and Information Application Technology.

Browne, D., and L. Ryan 2010. "Comparative analysis of evaluation techniques for transport policies." *Environmental Impact Assessment Review*.

CALTHROP, E. and S. PROOST 1998. "Road Transport Externalities." *Environmental and Resource Economics*, *11*(1992), 335-348.

ExterneE 2010."The ExternE Project series" online available under <http://www.externe.info/> last Accessed 3 March 2011.

Jakob, A; J. Craig, and G. Fisher 2006. "Transport cost analysis: a case study of the total costs of private and public transport in Auckland." *Environmental Science & Policy*, *9*(1), 55-66.

Li-qin, Z. 2004. "Research on the Externality of Operational Safety in Urban Underground Space." *Tunnelling and Underground Space Technology*, 19(4-5) 372 -375

Nickel, J.; A.M. Ross and D.H. Rhodes 2009. "Comparison of Project Evaluation Using Cost-Benefit Analysis and Multi- Attribute Tradespace Exploration in the Transportation Domain." *Second International on Engineering Systems*.

Sen, A. K., Tiwari, G., & Upadhyay, V. (2007). Should bus commuting be subsidized for providing quality transport services? — A case for Delhi. *Sadhana*, *32*(4), 329-345. doi: 10.1007/s12046-007-0028-4.

Tudela, A., Akiki, N., & Cisternas, R. (2006). Comparing the output of cost benefit and multi-criteria analysisAn application to urban transport investments. *Transportation Research Part A: Policy and Practice*, *40*(5), 414-423. doi: 10.1016/j.tra.2005.08.002.

Van Dender, K. 2009. "Energy policy in transport and transport policy." *Energy Policy*, *37*(10), 3854-3862.

Weisbrod, G.; T. Lynch, and M. Meyer 2009. "Extending monetary values to broader performance and impact measures: Transportation applications and lessons for other fields." *Evaluation and program planning*, *32*(4), 332-41.

Zhu, G.; G. Tong, and L. Dai 2008. "Analysis of urban road congestion pricing based on game theory." *2008 International Conference on Management Science and Engineering 15th Annual Conference Proceedings*, *l*, 1693-1697.