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Land transport policy in Ireland and Poland: A game theorist's view

Abstract. This paper looks at some of the challenges facing the development of a sustainable transport system in two EU countries, the Republic of Ireland and Poland. Both countries have seen a rapid rise in car ownership and migration of a large proportion of city dwellers to suburban areas just outside the city boundaries. Due to this, both the proportion of individuals traveling to work by car and the average commuting distance have risen significantly. This has placed a huge stress on urban and suburban transport networks. Although both countries have seen rapid economic development, many remote rural areas have not benefitted from this growth and are left with a decreasing and aging population. In order to deal with these problems, governments must coordinate their transport, spatial and regional policies. The government must take into account, and in the long run shape, the preferences of citizens (the users of transport networks). Also, it is necessary to develop policies which are robust to changes in the economic climate. This is particularly important in the light of the decision of the Irish government to rewrite its spatial plan. One may think of the development and use of the transport network as a dynamic, stochastic game played by three types of player: government (at international, national and regional level), transport providers (e.g. rail and bus services) and individual travelers (both commercial and private). These players all have different goals (payoff functions) and strategies available to them. They all should react to and predict the actions of the other players, as well as how behavior and the network will evolve in the future. This article concentrates on the goals of governments to develop a sustainable transport system. It argues that the governments of Ireland and Poland must develop attractive alternatives to the present ideal of living in the country and traveling by car, while protecting the interests of remoter rural areas, and give clear information about their plans and the benefits of sustainable development.

Keywords: transport systems, game theory, Poland, Ireland, sustainable transport

1. Introduction

The aim of this paper is to point out some of the challenges facing the development of a sustainable transport system in two EU countries, the Republic of



Ireland (henceforth referred to as Ireland) and Poland, from the point of view of game theory. For this purpose, we use the definition of sustainable development used in the so called Brundtland report¹:

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

- the concept of needs, in particular the essential needs of the world’s poor, to which overriding priority should be given and
- the idea of limitations imposed by the state of technology and social organization on the environment’s ability to meet present and future needs”.

Hence, a sustainable transport system should be able to meet the needs of the present generation in terms of affordable and reliable transport, in particular to work, while ensuring that the system can adapt to the needs of future generations. In order to protect the needs of future generations, the transport system should not lead e.g. to the depletion of fuels or the degradation of the natural environment. In addition, any national transport policy should give priority to those who are socially or economically disadvantaged.

In the last twelve years, both Ireland and Poland have seen a very rapid increase in the level of car ownership and migration from urban centers to suburbia or rural regions. These facts combined mean that not only has the number of car journeys greatly increased, but also the average length of a journey. This has put a great strain on the road network. A national transport policy must reverse this trend, since people are spending an increasing amount of time traveling, the environment is being depleted and motorized private transport is not fuel efficient. Hence, a sustainable transport policy must be accompanied by appropriate urban and spatial planning².

Section 2 will look at the problem of developing sustainable transport from the point of view of game theory. In order to do this, the players (actors) must be defined, together with the rules of the game (constraints), the actions the players can take and the payoffs obtained. Section 3 presents the present situation in Ireland under the National Development Plan (2007-2013), particularly in the light of the recent announcement of the scrapping of the National Spatial Strategy in favour of a new strategy to appear in 2014. The situation in Poland and the actions undertaken since Poland’s accession to the EU are presented in Section 4. Section 5 gives a conclusion and suggests several directions which might prove useful in both countries. It should be noted that in Sections 3 and 4 the author

¹ World Commission on Environment and Development, *Our Common Future*, Oxford University Press, Oxford 1987, p. 43.

² See: H. Geerlings, D. Stead, “The integration of land use planning, transport and environment in European policy and research”, *Transport Policy* 2003, Vol. 10, pp. 187-196.

makes use of his own experience as a cyclist and user of public transport, having spent a number of years as a resident in both countries.

2. Land Transport as a Stochastic Dynamic Game³

To describe a mathematical game, one must define the following: the players, the rules of the game including the actions available to each player and the pay-offs obtained by each player. One can distinguish between three types of player: governments (at regional, national and international level), transport providers and individual users of transport (households and business users). These players play a form of Stackelberg game, i.e. players make moves one after the other rather than simultaneously. That is to say, governments first make their decisions on investing in new roads and rail lines, road taxes, etc. Here, it is assumed that the EU makes strategical decisions at intervals. National governments' strategies are then developed and implemented at national level within the constraints of EU policy. Finally, regions develop and implement their own strategies within the framework defined by the higher levels of government. Transport providers make their decisions on prices and timetables based on the present infrastructure and government policies. Finally, individual users make their decisions on how to travel based on the options presently available to them. Two things should be noted here. Firstly, governments and (to some degree) transport providers set the rules of the game played by individual travelers. Secondly, this is a simplification of the real situation, as the game is dynamic and stochastic. That is to say, travelers make decisions on a day to day basis, the transport network evolves over time and both this network and demand depend on economic and other factors, which cannot be reliably forecasted, e.g. people are more likely to cycle to work on a sunny day. For these reasons, we should consider the decisions of users at two levels: firstly, immediate decisions based on the present transport network and the modes of transport available to them and long term decisions involving the purchase of vehicles and the choice of where to live. Also, governments and transport firms will react to the observed behavior of individual travelers.

Finally, one should define the payoffs of the players. This is difficult to do mathematically due to external costs (the effects of pollution and other environmental issues), but some general comments can be made. Since the game is dynamic, one should consider how payoffs are discounted over time. It is assumed that a party's political support depends on the national situation, hence

³ For an introduction to game theory see, e.g. J. Eichberger, *Game Theory for Economists*, Academic Press, Salt Lake City 1993 or R. Gibbons, *Game Theory for Applied Economists*, Princeton University Press, Princeton 1992.

national and regional governments will tend to be more short-sighted than the EU government. It follows that the payoffs to national and regional governments are discounted at a higher rate than payoffs to the EU government. These payoffs should take into account the economic benefits of transport together with the environmental costs at the appropriate level. It is assumed that transport providers maximize their expected sum of discounted profits starting from the present framework (government strategy, transport network and the behavior of individuals). Also, individual travelers minimize their travel costs within this framework. These transport costs consist of journey time and financial costs. This is a somewhat pessimistic view of consumers. It makes the reasonable assumption that the negative effect of transport on the environment is not noticeable at the level of an individual, but at the level of the population. However, individuals' utility may be affected by the 'greenness' of the form of travel they use and health benefits that they might get from walking or cycling. Note also, that in this case, transport providers might have an incentive to provide green forms of travel. Finally, although individuals (transport providers) are assumed to minimize their costs (maximize their profits), they are affected by inertia. In the case of transport providers, this is due to employment laws and the costs involved in changing the modes of transport used. In the case of individuals, this reflects the habits they have and the time involved in the decision to move house, as well as to buy or sell a vehicle. Hence, an individual traveler is only likely to change the form of transport used when it is clearly optimal to do so.

According to the solution of such a game, a Nash equilibrium, any individual cannot decrease his travel costs by changing his patterns of traveling given the transport network and regulation, as well as the behavior of firms. It should be noted that such an equilibrium is likely not to be socially optimal (even when environmental costs can be ignored). This can be seen as follows. Suppose a group of individuals are forced to travel by bus to work rather than car. This might mean that their costs of traveling to work might increase. However, the resulting decrease in congestion might mean that the average costs incurred by commuters decreases. Hence, such a game is very similar to the tragedy of the commons⁴.

Note that there are some obvious differences between Ireland and Poland in the framework of such a game. Due to its geographical position, Poland is much more influenced by EU policy, since it must adapt to the EU strategy on international road and rail networks and cooperate with neighboring countries on these issues. Also, due to the differences in the sizes of the countries, the rail network in Ireland is subject to a national strategy, whereas in Poland there are regional lines subject to the regional government.

⁴ See: G. Hardin, "The tragedy of the commons", *Journal of Natural Resources Policy Research* 2009, Vol. 1, No. 3, pp. 243-253.

Hence, when developing a sustainable transport strategy, governments have to consider how transport providers and individual travelers will react to changes in the transport network. As well as ensuring short journey times, the governments of Ireland and Poland must counteract the rapid increase in car travel, which is accompanied by the 'rural sprawl' observed in both countries. In order to do this, governments must have coherent strategies in the following fields: transport, spatial planning and regional development.

3. Transport Policy in the Republic of Ireland⁵

The Republic of Ireland experienced a major economic boom at the end of the second millenium. This had a huge effect on the lifestyle of the Irish population. The number of cars registered increased almost fourfold in the period 1991-2002 from 445 thousand to 1,602 thousand. This was accompanied by a housing boom, which was characterized by a large number of suburban estates, as well as a large number of people buying second homes in the country. This meant that both the number and average length of car journeys increased. Very often the planning of these estates positively encouraged people to travel by car, even over very short distances (e.g. from personal experience, there were estates separated by high fences, such that in order to get between two houses which were around 100 m apart 'as the crow flies' a journey of around 2 km had to be undertaken). According to the 1991 census, 47% of the working population travelled to work by car. By 2002, this figure had increased to 62%. These percentages only tell part of the story, since the working population almost doubled over this period, due to the boom. This rapid increase in the number of vehicles placed a great strain on the road network. The often narrow streets in town centers were completely unadapted to such traffic, which accelerated the expansion of suburban shopping centers.

A major priority in recent times has been the construction of motorways. Ireland has a dense network of local roads, but the quality of many of these roads needs improvement.

Public road transport, apart from local transport in Dublin (run by Dublin Bus), is dominated by Bus Eireann. The services between large towns are regular and reliable. However, services to rural areas are limited. Local services in large towns are unreliable, in Dublin due to traffic jams (buses have limited priority), in Limerick due to the lack of timetables (also, the author noted that a number of bus stops were unmarked).

⁵ Much of the data from this section is taken from Irish Ministry of Transport, *A Sustainable Transport Future: A New Transport for Ireland 2009-2020*, Dublin 2009.

Over 20% of the population live in Dublin, the capital city, with around 40% living in the Greater Dublin Area. Apart from the bus service, the LUAS tram network was opened in 2004, which carries around 80,000 passengers daily and is being extended. There is a partial network of bus lanes, which cyclists can also use. Due to the flat terrain and mild climate in comparison to the urban centers in the west, cycling is reasonably popular in Dublin. A bicycle scheme was started in 2009, such that people can borrow bicycles from strategic transport hubs. This scheme has been very successful (around 83,000 journeys per month in the first year) and is being extended. Even so, traffic levels in and around Dublin are very high.

The rail network was limited to connections between major settlements. Rail tickets are generally much more expensive than bus tickets, apart from a few special offers on off-peak rail tickets. This seems to be strongly related to the use of rail travel for business travel⁶. At present, there is no direct rail connection between Cork and Limerick (the second and third largest settlements in Ireland), which are only 100 km apart.

The rail connection between Limerick and Galway (the third and fourth largest settlements in the Republic) had been in disuse for a long period and only returned into service in 2010. This service is not well used. Irish Rail reported in 2012 that only 16% of the seats were occupied. One reason for this is the recent extension of the western corridor motorway. Express bus services from Limerick to Galway are cheaper and faster. Another reason is the present economic crisis, which has halted the rapid increase in demand for transport.

The population grew by 17% between 1996 and 2006. Most of this growth was in suburban regions, particularly around Dublin. In this decade, the average distance travelled to work doubled. Although the population density of Ireland remains low, the National Development plan for Ireland 2007-2013 notes the clear positive relation between the level of urbanization and economic performance. Much of the Irish landscape had come to be dominated by suburbia and rural sprawl. On the other hand, the population (and economy) of many rural regions, especially in the midlands and close to the border with Northern Ireland, continued to decline and age. This has led to social exclusion in rural areas⁷.

The above phenomena mean that any transport policy has to relieve the pressure on the road network and remove congestion in urban areas by providing an integrated, efficient public transport able to compete with private transport. In addition, such a transport plan must work in conjunction with urban planning and a spatial strategy to counteract the effect of the increasing suburbanization

⁶ See: G. Cafferkey, B. Caulfield, *Examining the Barriers to Sustainable Inter-city Transport in Ireland*, Transportation Research Board 91st Annual Meeting 2012, No. 12-0747.

⁷ See: J. McDonagh, "Transport policy instruments and transport-related social exclusion in rural Republic of Ireland", *Journal of Transport Geography* 2006, Vol. 14, pp. 355-366.

of Ireland on the level of private transport. Finally, the transport strategy must complement the rural development strategy to prevent the exclusion of rural communities.

The main strategy documents regarding the present transport strategy in Ireland are: the National Development Plan 2007-2013 (NDP)⁸, the National Spatial Strategy for Ireland 2002-2020 (NSS)⁹ and "Smarter Travel": A Sustainable Transport Future (STF)¹⁰. STF was published after consultation with the public. It should be noted that the NSS was scrapped in February 2013 and is to be replaced by a new spatial strategy in 2014. However, the NSS was important in deciding on what the main goals of the present transport strategy are and will continue to be important, at least in strategic terms. Hence, it is important to look at how the NSS affected STF and the reasons for it being scrapped.

One of the ways that the strategy integrated transport policy, spatial policy and rural development is by the designation of gateways (ports, airports, urban centers) and hubs (areas with particular needs). These are spread reasonably evenly over the country at strategic sites and thus promote balanced development, an element of sustainable development. As well as finding solutions to transport problems in the major cities, development of the transport network around Monaghan and Cavan (a rural, relatively less developed region on the border with Northern Ireland) is prioritized.

One of the goals of the spatial plan is to combat the dominance of the Greater Dublin Area. Towards the end of the 20th century a large number of hi-tech firms were set up on the outskirts of the city. There was a high level of immigration into the area. Many commuters were traveling up to 80 km to work. Although the road network in the area was rapidly developed to cope with this traffic, such development is not sustainable in the long run. The spatial plan stressed the importance of the development of three towns in the midlands (Athlone, Tullamore and Mullingar) to counterbalance the expansion of Dublin and emigration from the midlands.

The urban centers in the west of Ireland (Cork, Limerick, Galway) were developing steadily until the banking crisis. However, the centers of these towns were very congested and public transport unreliable and thus rarely used. The spatial plan recommended the revitalization of city centers, especially close to public transport links.

With regard to rural development, the spatial plan noted the decreasing importance of agriculture in employment and the increase in the numbers of residents

⁸ Irish Government, *National Development Plan 2007-2013*, Irish Government Publications, Dublin 2007.

⁹ Irish Government, *National Spatial Strategy for Ireland 2002-2020*, Irish Government Publications, Dublin 2002.

¹⁰ Irish Ministry of Transport, *A Sustainable Transport Future...*, op. cit.

of urban areas buying second homes in rural areas, especially on the west coast of Ireland. It was recommended that people working in a rural area should have priority to new residential developments in that area. However, this can be a politically divisive policy.

Jim Walsh considers the role of the national spatial strategy in achieving balanced regional development¹¹. He notes that in the 1990s the majority of towns with a population of more than 5,000 grew in this period, while the majority of villages of population less than 1,500 shrank. The lowest rate of increase in employment during this boom period was noted in remote rural areas, particularly in the midlands and close to the border with Northern Ireland. There are a large number of small villages in Ireland and this means that it is difficult to achieve the joint goals of balanced development and sustainable transport. Another problem was that a large proportion of the growth came from foreign direct investment and the growth of multinational companies in Ireland. Such firms had a very strong tendency to locate close to the major urban centers. For this reason, it was difficult to achieve balanced growth and control the spatial pattern of new developments. J. Walsh notes that towns need to achieve critical mass in terms of skills and population in order to grow economically. This growth then spreads to the area surrounding a town. He states that it is necessary to promote local innovation, the formation of networks and inter-regional forms of cooperation. Although the NSS did give priority to several less urbanized regions, there may not have been enough stress placed on promoting economic growth within communities themselves.

One major criticism of the NSS is that it was too ambitious. There are a large number of gateways and hubs and in the present climate of economic stagnation, rather than the predicted growth, the strategy is too expensive to implement. Another problem is that the strategy was seen to be too political and pick winners (priority areas) and losers (other regions). This can lead to social unrest, especially in a period of increasing unemployment¹².

Transport plays a very important role in the NDP. Transport is given almost EUR 33 bln in a projected budget for 2007-2013 of EUR 184 bln. The two main priorities are the construction of express roads (motorways and by-passes) and local public transport (particularly in Dublin). Over EUR 26 bln was to be spent on these two priorities with the money almost equally split. In addition, there was to be investment in rural transport initiatives, particularly transport on demand.

¹¹ J. Walsh, "The National Spatial Strategy as a framework for achieving balanced regional development", in: *Economy, Society and Peripherality – Experiences from the West of Ireland*, ed. J. McDonagh, Arlen House, Galway 2002, pp. 55-79.

¹² See: G. Daly, R. Kitchin, "Shrink smarter? Planning for spatial selectivity in population growth in Ireland", *Administration* 2013, Vol. 60, No. 3.

Specific objectives are given in the document on a Sustainable Transport Future (STF). The main aims of this plan are as follows:

1. Focusing population growth in areas close to individuals' place of work.
2. Pricing mechanisms to encourage changes in behavior.
3. Provide alternatives to car travel and increase fuel efficiency.
4. Strengthening institutional 'arrangements' (i.e. improving coordination between different levels of government, communication between local transport providers and government).

These goals were to be achieved using the following policies:

1. Charging for parking at suburban shopping centers and restricting parking at work places. Also, the building of new suburban shopping centers would be restricted and large employers should implement workplace travel plans. This is intended to favor city centers and encourage people to use public transport or increase vehicle occupancy by e.g. car sharing for commuting. It was intended to reduce the proportion of those driving to work from 65% to 45%.

2. Concentrate new places of employment and population growth in compact areas. The minimum housing density was to be between 35 and 50 dwellings per hectare. New housing should be concentrated in areas that have good public transport links. This is intended to limit the average length of journeys and encourage the use of public transport.

3. Encouraging work from home ('e-working'). Where possible, government workers should work from home at least one day a week. This would reduce commuting.

4. The promotion of local area plans and strategic development zones in urban areas. New residential developments, particularly housing estates, should be planned so that there is easy access to local facilities by foot.

5. Provision of public transport to educational facilities. Over 200,000 students/pupils travel to school/university by car less than 4 km.

6. Giving more priority to buses, e.g. increasing the number of bus lanes. Making public transport more integrated and efficient by using pre-paid integrated tickets, making transfer between different forms of public transport easier and coordination of timetables.

7. Increase the level of cycling by providing cycling lanes and the cycle to work scheme, which give tax incentives for people to buy bicycles. It was intended to increase the number of those cycling to work to around 160,000.

8. Promoting the use of efficient/sustainable fuels (biofuels, electric cars), especially in public transport. Car tax was to be related to the degree of emissions.

9. Improving transport services in rural areas. In particular, by providing transport on demand.

In assessing these aims, it should be said that the stress placed on local transport in cities is due heavily to the demands of travelers to live in rural areas and convenient,

particularly door to door, travel. Gerard Cafferkey and Brian Caulfield carried out a survey on the use of various forms of transport for journeys between cities (car, bus and rail)¹³. The shares of these forms of transport for business travel were: Car 55%, Rail 41%, Bus 4%. The shares for leisure trips were: Car 68%, Bus 20%, Rail 12%. Rail travel is seen as expensive, although comfortable, hence its high share for business travel. The respondents stated that reliability, convenience and time were the main factors in deciding which form of transport to use. One important factor in such travel are the links to one's final destination. Local transport is seen to be unreliable and very often inconvenient. Although rail and long distance bus transport are reasonably well integrated with public local transport in Dublin, they are not well integrated in Limerick or Galway and information on local transport is not readily available at the railway stations in the two aforementioned cities.

In some cases, more attention should have been paid to how individuals react to such changes. Providing public transport for university students seems a reasonable policy, since a lot of students travel to their place of study by car. On the other hand, the gains from such a policy may be limited, since from personal observations at Limerick University, students' cars showed a very high level of occupancy, while the free bus service from the more distant halls of residence was not heavily used. Also, restricting parking facilities at the university might encourage more people to use public transport. However, the public transport service to the university was limited and unreliable and moves to restrict parking were very heavily opposed. Finally, there was a policy of not enabling general vehicle access from the opposite bank of the Shannon as the university did not want to the campus to become a general thoroughfare. However, the limited access to the university resulted in traffic jams, especially during the afternoon rush hour.

With regard to the cycle to work scheme, it was intended that individuals would use their new bicycles to commute to work. However, it was impractical to check whether this was the case. In general, the cycle to work scheme was used by two groups of users: those who already cycle to work and used the scheme to buy a better bicycle than they would have otherwise and those who used their new bicycle for recreational purposes. Hence, the benefits of the scheme seem to be in possibly improving the health of those who take up recreational cycling. Cycle lanes have been introduced. However, for example, in Limerick there is no network of cycle lanes. Lanes often disappear and appear again a hundred meters later. This often leads to cyclists using the road (sometimes even against the flow of the traffic, since the disappearing cycle lane was on the wrong side of the road). Also, the general feeling among regular cyclists is that you are safer and more

¹³ G. Cafferkey, B. Caulfield, *op. cit.*

visible on the road than on a cycle lane. On the other hand, cyclists sometimes face aggression from drivers for not using the cycle lanes. Due to these factors and the vagaries of the Irish climate, the goal of increasing the number of cycling commuters to 160,000 seems very unrealistic.

The strategy of improving rural transport services seems very appropriate from the point of view of the possibility of social exclusion in rural areas¹⁴. However, there is a high dependence on private transport in rural areas and larger cars are required due to the use of trailers etc. for agricultural purposes. Such cars are subject to a higher rate of tax. These regulations do not take into account the profession of the user and may be seen to be unfair by many rural inhabitants.

The present economic stagnation might turn out to be a blessing in disguise for the development of sustainable transport. Although investment in the transport network has decreased, investment in construction has fallen dramatically. Hence, the spread of rural and suburban sprawl has stopped. On the other hand, government strategy did not seriously take into account the possibility of an economic downturn. For example, investing simultaneously in a rail and motorway connection between Limerick and Galway might seem to be overly ambitious even in a period of economic growth. Also, the government seemed not predict the reaction of Bus Eireann, who started an express connection between the two cities. This connection was faster than the rail connection, making the rail connection almost redundant in the present economic climate.

4. Transport Policy in Poland¹⁵

Poland is one of the transformation economies having become a capitalistic country in 1989 after the fall of the communist bloc. As such, the country had a very low level of car ownership which has grown very rapidly over the past 20 years. Before the transformation, the network of roads and railways was fairly dense, especially in the regions which had previously been under German rule. However, the network of express roads was virtually non-existent and many roads were in a poor state. The railways were adapted for the needs of industry, especially in the mining areas in Upper Silesia in the south of the country. Many of the lines were in a poor state, the locomotives old and rail transport was generally much slower than in Western Europe. The population

¹⁴ See: J. McDonagh, op. cit.

¹⁵ Much of the data from this section was taken from Polish Ministry of Infrastructure, *Polityka transportowa państwa na lata 2006-2025* [National Transport Policy: 2006-2025], Warszawa 2007.

has slightly fallen over the past 10 years, due particularly to emigration to other EU countries. However, the spatial changes in population show many similarities to the changes that have occurred in Ireland. There has been a large degree of emigration from cities to suburban areas just outside the city limits¹⁶. Remote rural areas (the east, the north-west and the western border) have become depopulated. The rapid increase in the number of cars and the increase in the average commute have placed large stress on the road network in and around urban areas. It is predicted that unless these changes are effectively managed, the proportion of commuters traveling by car will rise to over 60% by 2020 (i.e. to the levels observed in Ireland at present).

One difference between the two countries is that Poland is not dominated by the capital city, Warsaw, to the same degree. The Warsaw Metropolitan Region has a population of around 2.6 million, which is just under 7% of the total population. The other major cities are spread relatively evenly over the country, which is advantageous in achieving balanced regional development. On the other hand, as in Ireland there are a large number of small villages, which is problematic for the development of sustainable transport.

As in Ireland, economic growth has been fueled by foreign direct investment. Such investment tends to be located in and around either the largest cities (Warsaw, Krakow) or the dynamic cities located in the west (Poznań, Wrocław). However, some specially designated development areas have been successful in attracting investment (e.g. Wałbrzych).

Poland joined the EU in May 2004. Due to its geographical position Poland must adapt to the EU strategy for a Trans-European Transport Network (TEN-T). This involves the construction of international motorway connections (particularly with Germany, but also the Czech republic) and the modernization of the major rail lines to adapt to high speed international links. Many roads will also have to be improved in order to satisfy EU requirements to bear heavy vehicles. Although the quality of many trunk roads has improved over the past 10 years, the quality of many rural roads has deteriorated from an already poor state.

In the large urban centers, public transport is supplied by municipal transport companies, which are generally subsidized by the city government and have monopolies. These companies supply bus and tram transport. Road congestion causes some delays to bus services and, to a lesser degree, to tram services, particularly during peak periods. Bus transport between towns is supplied by regional PKS firms. In general, there are more rural transport services than in Ireland. However, these services are dependent on having roads of the appropriate

¹⁶ See: E. Gonda-Soroczyńska, "Przemiany strefy podmiejskiej Wrocławia w ostatnim dziesięcioleciu" [Changes in the region immediately surrounding Wrocław in the last decade], *Infrastruktura i Ekologia Terenów Wiejskich* 2009, No. 4, pp. 149-165.

quality, which is often not the case¹⁷. However, the market for public road transport has been liberalized and there is now competition, particularly on routes between the larger cities. Rail services are provided by PKP. This market has been liberalized to a lesser degree and services are provided by different servers (Inter-City, TLK – a provider of cheaper long distance rail travel, as well as regional services). Rail services are generally much slower than services in Western Europe. The modernization of trunk routes is causing delays on major routes (the Wrocław – Poznań route is presently very slow). There are four international TEN-T railway lines running through Poland: the Berlin – Warsaw – Moscow line, which runs east-west through the center of the country; the Berlin – Wrocław – Katowice – Krakow – Lviv line, which runs east-west through the south of the country, the Helsinki – Baltic States – Gdańsk – Warsaw line and the Gdynia/Gdańsk – Warsaw – Katowice – Wrocław line, which both run north-south through the center of the country.

The number of people cycling to work is low. The number of cycling lanes in cities has been increasing, but they do not really form a network. Poland's climate is not particularly conducive to commuting by bicycle, as the winters tend to be harsh and the summers very warm. The number of people cycling for recreational purposes has noticeably increased over the past decade.

The above factors mean that the priority of the government in recent years has been to build new express routes (motorways and by-passes) and road bridges to improve access in urban areas. Investment has been made in urban public transport systems to improve the integration of transport systems (integrated tickets, integrated bus and tram stops with up to date information on arrival times) and give public transport vehicles priority on the road. In general, expenditure on transport has been lower than planned. In 2009, it was planned in the national budget to spend 32.7 bln PLN (just under EUR 8 bln) on transport. However, expenditure was only 18.3 bln PLN (just under EUR 4.5 bln). The reasons for this included overambitious plans and lack of coordination between different levels of government, particularly regarding calls for tender¹⁸.

In February 2011, EU funds were redirected from investment in rail to investment in roads. This was a year of particularly high investment in road construction, due to a large degree to Poland being one of the hosts of the 2012 European Soccer Championships. A rapid improvement in transport links between the host cities (Warsaw, Gdańsk, Poznań and Wrocław) was required and such

¹⁷ Polish Ministry of Agriculture and Rural Development, *Krajowy plan strategiczny rozwoju obszarów wiejskich na lata 2007-2013* [National Strategic Plan for Rural Development in 2007-2013], Warszawa 2009.

¹⁸ See: W. Paprocki, *W Polsce brakuje spójnej polityki transportowej* [Poland lacks a coherent transport policy], 2011, <http://www.obserwatorfinansowy.pl/forma/debata/w-polsce-brakuje-spojnej-polityki-transportowej/> [8.04.2013].

rapid development of the rail links would have caused too much disruption. The government decided that instead of constructing new high-speed links between the major cities in the near future, there would be a comprehensive modernization of the railway network. In 2014 PKP is to buy Italian Pendolino express locomotives to service the Warsaw – Krakow/Katowice line.

Hence, Poland faces many of the tasks required to develop sustainable land transport that Ireland also faces (counteracting the effects of suburbanization and providing more efficient, integrated public transport). On the other hand, due to its geographical position and the requirements of the European Transport Strategy to expand the motorway network and improve international rail links, Poland faces more constraints. These constraints are likely to mean that rural areas are likely to lack the required investment to ensure balanced regional development. On the other hand, nearly all of the 16 Polish regions are eligible for EU regional development funds as the GDP per head does not exceed 75% of the EU average. The Mazovian region around Warsaw is no longer eligible for such funds. GDP in this region is around 40% higher than in any of the other regions. The regions with the lowest GDP are concentrated along the eastern border of Poland (Podkarpacki, Lubelski and Podlaski), which are very rural. On the other hand, the highest levels of unemployment are observed in the north and on the western border (Lubuski, Western Pomorski and Warmia-Mazuria).

The main documents pertaining to Poland's transport policy are the National Development Plan 2007-2015¹⁹, the National Concept for Spatial Planning until 2030²⁰, National Transport Policy 2006-2025²¹ and the Rural Development Plan 2007-2013²². Due to the large difference in size and, in particular, population between the two countries, for comparison and in order to look at specific investments resulting from the National Transport Policy we will look at the Transport Strategy for the Pomorski Region (Pomerania)²³. This is a medium-sized region with a population of about 2.2 million. The major urban centre is the so called Tri-City (Gdańsk, Gdynia and Sopot), which has a total population of around 0.75 million. This agglomeration is placed on the north coast close to the estuary

¹⁹ Polish Ministry of Regional Development, *Strategia rozwoju kraju 2007-2015* [National Development Plan 2007-2015], Warszawa 2006.

²⁰ Polish Ministry of Regional Development, *Koncepcja przestrzennego zagospodarowania kraju do 2030* [Spatial Management Plan for Poland until 2030], 2013, http://www.mrr.gov.pl/rozwój/regionalny/Polityka_przestrzenna/KPZK/Strony/Koncepcja_Przestrzennego_Zagospodarowania_Kraju.aspx [8.04.2013].

²¹ Polish Ministry of Infrastructure, *Polityka transportowa państwa...*, op. cit.

²² Polish Ministry of Agriculture and Rural Development, *Krajowy plan strategiczny...*, op. cit.

²³ Parliament of the Pomorski Region, *Regionalna strategia rozwoju transportu w województwie pomorskim na lata 2007-2020* [Regional Transport Policy in Pomerania for 2007-2020], Gdańsk 2008.

of the Vistula river. The rest of the region is much less densely populated (the next largest town is Słupsk, which has around 95,000 inhabitants). Gdańsk and Gdynia are the industrial centers (historically associated with shipbuilding, although the Gdynia shipyard went into liquidation in 2009). Sopot, Gdańsk and the rest of the coast are tourist centers, together with Malbork castle and the Kaszuba region both to the south of Gdańsk.

Development of infrastructure is the second priority of the National Development Plan (after promoting competitiveness and innovation). The plan acknowledges the rapid rise in the number of cars and the urgent need for investment in roads and rail transport. At the same time, in order for the patterns of transport to be sustainable, environmentally friendly forms of transport must be promoted. The strategy poses the question as to whether a few major projects (e.g. motorways) should be funded or a large number of small projects. The constraints placed on Poland by the strategy for a European transport network seem to indicate that major projects will be favoured. The plan also acknowledges that there is a choice between investing in strong areas (which will lead to faster economic development) or supporting weaker areas (which will lead to more balanced development). The strategy presented seems to favor investment in strong areas, since the main goals of the development of transport infrastructure are as follows: to develop express routes at regional, national and international level (particularly to Germany, as well as to the Czech Republic and eventually to Slovakia and Ukraine), improve access in the corridors around these express routes and to promote integrated transport, particular municipal public transport and logistic centers. The strategy does state that improving access to express routes in rural areas is a particular priority, but these tend to be rural areas which are economically relatively strong already. There is a need for by-passes of major towns and cities, as well as the construction of bridges in cities on major rivers (e.g. Wrocław, Warsaw). It is noted that the rail network is dense (particularly in the south). However, the technical state of many of the lines is very poor and as a result there are no high speed rail connections.

The National Transport Policy for 2006-2025 makes many of the same comments. It notes the more stringent legal requirements for express roads following EU accession. It states that expenditure on transport had been relatively low during the transformation period and that without investment in public transport by 2020 the pattern of commuting would be similar to the one seen at present in Ireland (i.e. over 60% of commuters travelling by car). However, it sees EU funding as a great opportunity to develop a sustainable transport network. The transport market was liberalized (most express routes are toll roads and there is more competition now in public transport). The need to combat suburbanization, i.e. the transport strategy must complement the National Concept for Spatial Planning, was stressed. Taxation systems should take into account external costs (e.g. emissions).

The issues of rural development and regional development are given as Priority 5 and Priority 6. Income inequality between urban areas, together with their surroundings, and remote rural areas has increased over the last 20 years. The state of many rural roads is very poor, but investment in repairing these roads is of lower priority than the construction of express routes. The policy of regional development is to develop cities as centers of innovation and technology. The economic activity in the cities will promote the development of the surrounding areas and the corridors between the cities. This is a policy of hub and corridor formation. The Polish population is reasonably well spread. Hence, such development should affect a very large proportion of the country's area and population. However, such a policy may well lead to increasing levels of poverty in remote rural areas, particularly on the eastern border.

The 2009 report on the Rural Development Plan states that the large number of small villages is a barrier to the development of sustainable transport. There are a significantly higher number of children and retired people in rural areas: 67 people of non-working age per 100 of working age, than in urban areas: 52 people of non-working age per 100 of working age. Hence, there is a need for transport to essential health and educational services.

Polish central government seems to be placing a more integrated approach to and higher importance on spatial planning, since in the summer of 2012 spatial and urban planning became the responsibility of the Ministry of Regional Development. This led to the recent document "The National Concept for Spatial Planning until 2030", which is in general agreement with the transport strategy. It notes that there is a need to promote rail travel in urban areas (both trams and trains). As in Ireland, there should be a preference for regenerating urban areas, rather than building in greenfield sites. For example, there have been successful transformations of former textile factories in Łódź to shopping centers and residential flats. There is a lack of facilities in suburban areas. This has caused a rapid rise in the level of private transport. Future development should concentrate on improving public transport in large suburban estates and ensuring that new estates have a relatively high density of residences and good access to facilities, including public transport. The spatial plan states that there is a great need for the expansion of urban planning. For example, only 4.5% of the area of Łódź and 14.1% of the area of Krakow were covered by a spatial plan. The spatial plan develops the concept of hub and corridor formation by stating that if a region is particularly adapted to a particular industry for geographic or historical reasons then this should be supported²⁴. The western and eastern borders of Poland are underdeveloped. Integration with the EU could help

²⁴ See also: K. Romaniuk, "The potential of clusters as a driving force for regional development in Poland", *Olsztyn Economic Journal* 2011, Vol. 6, No. 2, pp. 319-330.

development in the west, but it seems that most investment in this border region is going to Germany. Transport links to these border areas should be improved. However, due to present constraints this is a long term goal, particularly in the case of the eastern border²⁵).

Finally, we consider the Transport Policy of the Pomorski region for 2007-2020²⁶. This was developed in consultation with other government bodies rather than the public. It was predicted that there would be very little change in the population of the region. The urban population was predicted to fall by 5.1% and the rural population increase by 13.8%. These changes would result mainly from emigration from the Tri-City to the surrounding area. The number of retired people would increase. As a result, it was predicted that the overall level of demand for transport from individuals would not increase greatly, but its pattern would (longer commutes in the Tri-City area). There would be a more significant increase in the demand for business transport. Much of the road and rail network was in poor repair. Car ownership was 289 per 1,000 inhabitants in 2002 and was projected to increase to 380 per 1,000 inhabitants by 2020. As a result, the proportion of commuters traveling by car is projected to rise to 60-70%. The traffic on major roads (particularly those around the Tri-City) is predicted to almost double by the end of the period.

The strategic goal of the transport policy for the Pomorski region is stated to be: The creation of a balanced, integrated and environmentally friendly transport system, ensuring good access and a high level of service and thus leading to an improvement in the quality of life of the inhabitants, economic growth and increased attractiveness to potential investors.

In order to achieve this goal, the following operational goals are defined:

1. Increase access.
2. Increase the quality of service and infrastructure.
3. Reduce road congestion.
4. Integration of different modes of transport.
5. Increase safety.
6. Reduce the negative effects of transport on the environment.

The following are projects of national importance: construction of the Pomorski section of the A1 motorway (connecting Gdańsk with Bydgoszcz, Toruń and Łódź) and the S6 and S7 express roads (connecting Gdańsk with Szczecin and Warsaw, respectively). Construction of road bridges across the Vistula river. The

²⁵ See: A. Hałasiewicz, *Rozwój obszarów wiejskich w kontekście zróżnicowań przestrzennych w Polsce i budowania spójności terytorialnej kraju* [Rural development in Poland within the context of spatial variation and territorial coherence], 2011, http://www.gov.pl/rozwoj_regionalny/Ewaluacja_i_analizy/Raport_o_rowju/Raporty_krajowe/Documents/Ekspertyza_Rozwoj_%20obszarow_wiejskich_09082011.pdf [8.04.2013].

²⁶ Parliament of the Pomorski Region, *Regionalna strategia rozwoju...*, op. cit.

development of high-speed rail lines to Szczecin and to Warsaw and the modernization of trunk railway lines.

The aims of projects which are important at regional level are to modernize regional roads between urban centers and in touristic regions and to modernize regional railway lines which could reduce road congestion and/or activate local communities.

In the region of the Tri-City the aims are as follows: to reduce journey times, construct high-capacity roads both for transit and access to the city, renovate railway lines to the city to compete with road transport, construction of a new urban rail line with access to the airport. Pedestrian and cycle access to facilities and city centers will be improved. Specific aims for municipal public transport are considered below.

In touristic areas the aims are to: increase the capacity and quality of roads leading to resorts, improving access and safety for pedestrians and cyclists, renovation of railway lines and construction of a Kaszubian line. Special attention is to be paid to environmental protection in areas of natural beauty, particularly in areas protected by law.

Municipal transport in the Tri-City was one of the major priorities of the policy. The quality of service to travelers would be increased by the purchase and modernization of vehicles, integration of different modes of transport (e.g. integrated tickets valid for all forms of public transport in the Tri-City), urban transport management and information systems would be implemented. The infrastructure would be adapted to cope with higher levels of municipal transport (e.g. bus lanes, integrated bus-tram stops²⁷) and new tram routes would be constructed. In future, the spatial plan for the Tri-City area would be integrated with the development of municipal transport. Many of these changes are in line with the recommendation of the actions of the three municipalities to be more coordinated²⁸.

One good point of the policy is that particular goals are stated explicitly, e.g. by 2020 50% of travel in the city will be by public transport and 80% of the regional roads will be in a good technical state.

To summarize, there are certain common characteristics between the situation in Poland and Ireland. Both countries have seen almost uncontrolled expansion of suburbia and a rapid increase in the level of car ownership over the last 20 years. As a result, both the proportion of people commuting by car and the average com-

²⁷ See: K. Solecka, "Integration of public transport in Polish and EU documents and examples of solutions for integration of public transport in Poland and in the world", *Transport Problems – Problemy Transportu* 2011, Vol. 6, No. 4, pp. 23-34.

²⁸ See: J. Pietruszewski, M. Kubiak, "O współpracy w metropolii Trójmiasta" [About co-operation in Tri-City (Gdańsk, Gdynia, Sopot) Metropolis], *Studia Lokalne i Regionalne* 2005, Vol. 1, No. 19, pp. 83-94.

muting distance have increased. This has placed an enormous stress on urban transport networks. Hence, unsurprisingly both countries are investing heavily in municipal transport and by-passes which allow transit vehicles to avoid the city. Both countries are also integrating their transport and spatial plans in order to reduce urban sprawl and ensure that new building developments have good public transport links. Both Ireland and Poland have rail networks which do not satisfy the requirements of travelers. In Ireland, tickets are generally expensive and very often the road links between cities are faster than rail links. The rail network in Poland is much denser, but requires investment, as services are much slower than in western European countries and Poland must be integrated into the EU rail network.

Due to these factors and the requirement in the present world market of reaching critical mass before becoming competitive, concentration on urban and intercity transport are logical. However, such policies could lead to imbalanced regional development and exclusion in rural areas. In both countries, the rural population is aging and relatively poor. Many of these people are unable to move house, thus a lack of public transport in rural areas could be a major factor leading to social exclusion.

Both countries need a transport policy with a long term vision which will solve both the problems of urban and intercity transport, while enabling balanced regional development. It is impossible to change the habits, homes and commuting practices of people overnight. Investment in public transport will not show immediate effects, since individuals must see that public transport is an efficient and pleasurable option before switching from private transport. In the long term, integrating spatial planning and transport policy, as well as gaining acceptance and support for public transport, will be of crucial importance in developing a sustainable transport policy. This will be investigated in the conclusion.

5. Conclusion and Suggestions

Georgina Santos et al. give a wide ranging view of policy instruments for sustainable transport, particularly in cities²⁹. The examples of the three cities considered in this section (Copenhagen, Vancouver and London) come from that article, together with the author's personal experience. These can be split into physical (infrastructure, public transport and land use) and soft (education, taxation, subsidization). In both Poland and Ireland, high importance is placed on the freedom of having and using a car and living in the country. When correctly used, education,

²⁹ G. Santos, H. Behrendt, A. Teytelboym, "Policy instruments for sustainable road transport. Part II", *Research in Transportation Economics* 2010, Vol. 28, No. 1, pp. 46-91.

transport policy and spatial planning can lead to people changing their priorities without causing conflict. For example, Copenhagen had a long term plan for spatial planning and public transport. The urban development is in the shape of a hand. The 'palm' is the central district which has a mainly commercial and administrative role. The 'fingers' are residential areas, together with necessary facilities. These areas are serviced by a rail network. This urban landscape guaranteed that the vast majority of the city's population lived both close to countryside and the main public transport arteries. The average commuting distance in Copenhagen is greater than in most cities of a comparable population, but travel is fast and environmentally friendly due to the efficient rail network. The number of parking spaces is decreased each year by 3%. This slow change ensures that people are not forced to change their habits overnight. They can continue to drive into the city center, but one by one they come to see the benefits of public transport (less congestion, no need to find a parking space). Rail lines also use space more efficiently than a road network and this leads to revitalization of the city centre. There is a well developed cycle network and the level of cycling is very high by European standards.

Many North American cities are characterized by urban sprawl, which leads to people being very dependent on cars. However, several of the Pacific coast cities, e.g. Portland and Vancouver, have a very different structure, due to long term planning. Many of these policies were initially rather controversial, but have received acceptance. Instead of improving road access to the city by building e.g. a multi-lane highway into the city center, Vancouver decided to invest in public transport, particularly in a light rail system. A local petrol tax was also introduced. These policies mean that the city is far more compact than many North American cities, but is not congested. The city center is attractive to pedestrians and cyclists, since there are large green areas (Stanley Park and Queen Victoria Park). Recent investment has turned the old industrial area of Gastown into a pedestrian precinct, which is attractive to tourists.

In London, the 'congestion charge' paid by private vehicles to enter the city centre was initially very controversial, but congestion in the city has noticeably decreased. Between 7am and 10am, 89% of travelers use public transport. This means that public transport is seen as classless, unlike in the cities of Poland and Ireland, where it is seen as being for those less well off.

Hence, it is possible to increase the proportion of people using public transport by investing in the appropriate infrastructure and applying policies that support this. Education is also important in this process. People's behavior will not change overnight, but education can form trends and preference for 'green' behavior, especially among children.

The policies of a particular municipal government should depend on the present state of cities, landscape and climate. For example, in order to reduce the

level of traffic in Polish cities, the number of car parks in the city center should be limited and park and ride stations set up at the major access roads to the city. Due to Poland's relatively harsh winters, in order to obtain an effective transport network all year round, initial investment should aim to achieve an efficient, attractive public transport system. The major cities seem to be heading in this direction with a high level of investment in vehicles, management and information systems, as well as integrated bus-tram stops. City governments must also pay more attention to urban planning, making cities attractive places to live in and making these plans public. Urban developments must go hand in hand with development of the public transport network. City governments must stress the need for sustainable development. Gradually, people should come to accept that the choice of where they live should depend more on easy access to their place of work and facilities, since there are attractive places to live that satisfy this condition.

Investment should also be made in pedestrian and cycling access. Cycling will only be an attractive means of commuting in the warmer months. However, the flat landscapes of the vast majority of Polish cities are ideal for cycling in the spring, summer and early autumn. Establishing a network of cycling paths will both reduce pollution and help improve the health of city residents. For example, Wrocław has introduced a bicycle rental scheme. Tourism could be enhanced by setting up a network of cycle lanes connecting the center, Ostrów Tumski and the attractions in the region of Park Szczytnicki. The dykes of the Oder river could be used to enable cycle access over greater distances and for recreational cycling. At present, cycling is seen as a dangerous mode of transport. However, G. Santos et al. note the experience of countries in which the level of cycling has recently increased: safety increases dramatically, since motorists are much more aware of cyclists³⁰. Hence, in the long run, investment in cycling lanes could well lead to a major increase in the level of cycling as the benefits of cycling become more visible.

However, concentration on urban and intercity transport will increase the present imbalance in regional development. Many rural roads are in a very poor state and modernization is required to provide the inhabitants of rural area access to retail, health and educational facilities. For example, due to their natural environments, the rural areas in the south and east of Poland would be attractive for tourism. However, there must be access to these areas.

The Polish railway system is in dire need of modernization. EU funds are available for this. In 2011 the Polish government decided that there will be comprehensive modernization of the existing network rather than the construction of new high-speed intercity rail connections. In 2014 PKP will buy high speed Pendolino trains for the main Warsaw – Krakow/Katowice line. The present work

³⁰ G. Santos, H. Behrendt, A. Teytelboym, op. cit.

on the lines is causing a large degree of disruption. In the long term, PKP faces an uphill battle to improve its reputation and provide an attractive service to travelers.

Due to geographical similarities, the German transport system seems to be a good example for the Polish transport system to follow³¹. The different modes of public transport are well integrated and large cycle parks are available at train stations. Monthly integrated tickets are relatively cheap compared to individual tickets, which promotes commuting by public transport. Deutsche Bahn issues a wide range of tickets aimed e.g. at encouraging groups and families to travel by rail and supplies detailed information about connections. The German spatial strategy is based around relatively high density residential estates with easy access to crucial facilities. These factors both decrease the average length of a journey and make people more likely to make use of public transport.

The Irish transport system also needs to be more integrated with the spatial plan. The revised spatial plan to appear in 2014 will be crucial in this regard. Irish Rail needs to become more attractive, especially to non-commercial travel. There is a lack of integration between rail travel and local transport. Some improvement has been made in Dublin with the LUAS tram service proving successful. Regarding local transport outside of Dublin, the lack of information and resulting unreliability of local bus services makes it highly uncompetitive with private transport. Irish cities are struggling with congestion and an acute lack of car parking facilities. However, the solution to this problem is not to enable the building of new roads and car parks, which would put even more strain on cramped city centers unadapted to life in the 21st century, but to provide improved local transport. Due to the present suburbanization and popularity of the car, such a policy would be controversial and require time and promotion before the effects become visible. However, such an approach is a necessity. In order to achieve balanced regional development, transport on demand services could prove useful in rural areas, especially as these areas often have aging populations.

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³¹ See: Buehler R., Pucher J., Kunert U., *Making transportation sustainable: Insights from Germany*, Brookings Institution Metropolitan Policy Program, Brookings Institution 2010.

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Polityka transportu drogowego w Irlandii i w Polsce z perspektywy teorii gier

Streszczenie. W artykule skoncentrowano się na wybranych zagadnieniach związanych z rozwojem zrównoważonych systemów transportowych w dwóch krajach Unii Europejskiej: Irlandii i Polsce. W obu tych państwach następuje gwałtowne zwiększanie się liczby samochodów oraz migracja znacznej części mieszkańców miast na suburbia. Z tego względu istotnie wzrasta liczba osób dojeżdżających do pracy samochodem, a także średnia odległość pomiędzy miejscem zamieszkania a miejscem pracy. To z kolei powoduje przeciążenia systemu transportowego miast i stref podmiejskich. Choć w obydwu omawianych państwach miał miejsce szybki rozwój gospodarczy, wiele odseparowanych obszarów wiejskich nie odniosło z niego korzyści i zmagają się z problemem malejącej i starzejącej się populacji. W celu rozwiązania tych trudności, władze powinny koordynować politykę transportową, przestrzenną oraz regionalną. Należy wziąć pod uwagę, i to w długim terminie, preferencje obywateli (użytkowników sieci transportowych). Niezbędny jest także rozwój polityk odpornych na wyzwania wynikające z klimatu gospodarczego. Staje się to szczególnie ważne w świetle decyzji rządu irlandzkiego dotyczącej zmian planu przestrzennego. Można sądzić, że rozwój i wykorzystanie systemu transportowego to dynamiczna, stochastyczna gra z udziałem trzech rodzajów graczy: rządu (na poziomie międzynarodowym, narodowym i regionalnym), przewoźników (np. usługi kolejowe, autobusowe) oraz indywidualnych podróżnych (zarówno komercyjnych, jak też prywatnych). Gracze ci mają odmienne cele (funkcje wypłat) oraz dostępne strategie. Wszyscy powinni reagować i przewidywać działania innych graczy, a także prognozować, jak zachowania i system transportowy będą ewoluować w przyszłości. W niniejszym artykule skupiono się na celach rządów dotyczących rozwoju zrównoważonych systemów transportowych. Stwierdzono w nim, że rządy Irlandii i Polski muszą rozwinąć atrakcyjne alternatywy dla obecnego ideału życia na wsi i podróżowania samochodem, chroniąc jednocześnie interesy odosobnionych obszarów wiejskich, jak również jasno i wyraźnie informować społeczeństwo o swoich planach oraz korzyściach wynikających ze zrównoważonego rozwoju.

Słowa kluczowe: systemy transportowe, teoria gier, Polska, Irlandia, zrównoważony transport