INTEGRATED TICKETING IN PASSENGER TRANSPORT AS A CHANCE TO IMPROVE INTERCONNECTIVITY

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ABSTRACT

The integrated ticketing is closely connected with interconnectivity of long and short distance passenger transport. The interconnectivity is a topic of the 7 Framework Programme project INTERCONNECT (Interconnection between short and long-distance transport networks) coordinated by Napier University (University of Gdansk is one of the partner in the project), started in June 2009. In the paper authors aim at presenting some assumptions and results of the study using examples of integrated ticketing practice in Poland, Germany and Italy.

Effective interconnection results in greater efficiency and reduced environmental impact of passenger transport by encouragement of integration, co-operation and, where appropriate, competition in the provision of services. Effective interconnection requires the provision of integrated networks and services which are attractive and friendly to the users. Therefore, integrated ticketing could be perceived as necessary requirement of better interconnectivity. It allows passengers to use same ticket on different transport modes and/or across different transport operators and in doing so experience a seamless journey.

In the paper authors identify potential schemes of integrated ticketing based on existing solutions. Although idea of integrated ticketing is not new there are surprisingly few working examples in world transport sector. Thus while examining current solutions also new potential models for integration of ticketing across and within modes will be discussed. Authors also aim at assessing preconditions and barriers of implementation of above solutions as well as methods and ways to overcome them.

The integrated ticketing can be introduced by implementing packages which allow tickets for the whole journey to be purchased in one transaction – seemingly easy method. But as practice proves some specific problems can arise, e.g. special discounts for local links or integration of transport facilities (e.g. easy access to city public transport from airports etc.), division of financial responsibility, need to improve information systems etc. Those operational problems create significant barriers and are main reason why idea is not widely spread in practice. However new developments – especially in the information technology

allows for integrated ticketing taking advantage from new technologies potential created for example by inventions like Internet or mobile telephony.

In wider view integrated ticketing can be viewed as a chance to improve economic efficiency, to promote local development or to reduce environmental harmfulness of bad or non-existing interconnections. Careful analysis will allow also to weight disadvantages resulting from its introduction while social equity and feasibility of the implementation of new solutions should be observed.

Keywords: transport interconnectivity, integrated ticketing, integration of transport systems, interconnection

INTRODUCTION

Integrated ticketing is not an objective itself. The solution seems to be closely connected with the improvement of interconnection. Effective interconnection requires the provision of integrated networks and services which are attractive and friendly to the users. Integrated ticketing and pricing improves interconnectivity mainly through making the trip friendlier for transport users. It allows passengers to use same ticket on different transport modes and/or across different transport operators and so experience a seamless journey.

In the paper the EU policy in the context of improving interconnectivity through integrated ticketing is reviewed. Then, current practice of several countries is taken into consideration. Since the paper is mainly based on the experiences of INTERCONNECT project, then authors gave included countries covered in the practical review in the project, i.e. Italy, Germany and Poland. Finally, information from the case studies and existing practice throughout Europe are used to identify differentiated types of systems and barriers of implementation as well as effects on public transport development.

DEFINITIONS AND OBJECTIVES

Integrated ticketing can be easy defined as the purchase of a single ticket to allow travel on one or more modes of transport provided by one or more operators (NZTA, 2008). An integrated ticketing system is one where the passengers have the ability to use a single ticket regardless of the service used. Thus this single ticket could be used on all trains, buses and ferries in the region .

A ticket described as integrated should be multi-modal and multi-operator, however in practice where only one operator is the dominant mode (e.g. bus) a multi-operator bus ticket may be considered as “integrated” (Scottish Executive Social Research, 2004).

It is obvious that integrated ticket should be **friendly for the users**.

> *“Through ticketing and simpler and more transparent and easily understood ticketing can contribute towards reduced deterrence of*

> *potential users by enabling more seamless travel and reducing factors such as confusion over eligibility or times of travel using discounted tickets."* (Scottish Executive, 2002).

Ticketing should be focused on the passenger, encourage use of public transport and be integrated across transport networks. It should not be fragmented and complicated - the right balance needs to be struck between choice and complexity. There is a clear desire from the public for greater integration of tickets, particularly across local networks, and for better use of technology. But some other objectives seem to be important in the context of transport policy issues. Integrated ticketing is very closely connected with pricing, regulatory and organisation framework.

In order to provide an integrated ticket to the customer **pricing** have to be kept easier or at least more calculable in an easier way. The regulations for price reductions have to be harmonised in order to make the comprehensibility and the transferability of regulations possible. Common pricing and the possibility of getting a ticket reaching across concern an important aspect (Kite, 2009).

Integrated ticketing may be useful in solving some organisational and regulatory problems on the transport market. Very often modal change may pose ticketing problems if there is no common issuing agent and there is the question of the **responsibility** of various modes if delays on earlier legs of a trip prevent catching a service on a later leg (ECMT, 2003).

Another important issue is the revenue use from transport charges and taxes. Improvement of interconnection, including integrated ticketing could be implemented with the public acceptance and co-funded with transport charges. The **allocation of revenue use** within the public transport services shows a public preference for the spending of revenues to improve real time information, reliability, integrated ticketing, fare reductions and network coverage (Road user charging, 2005).

Integrated ticketing and pricing can be also studied from the point of view of collusive regimes. Alternative pricing and regulatory strategies within a simple transport network with Cournot duopoly and differentiated demands are explored in the paper *On the Economics of Integrated Ticketing.* It is shown that whilst firms always prefer to offer integrated ticketing, a social planner will not. With integrated ticketing, the firms always prefer complete collusion but there is not a uniform ranking of some of the less collusive regimes. Society generally prefers the less collusive regimes to complete collusion but prefers some collusion to independent pricing (McHardy et.al. 2005).

Integrated ticketing may be introduced:

1. To complement an integrated fares policy, where all operators agree to a single fare structure in their operating area.
2. Alongside existing fares or products of operators. Planning, programming and funding manual is for instance the first to be published by the NZ Transport Agency (NZTA, 2008).

Integrated ticketing schemes may be broadly described accordingly to:

1. The modes on which they permit travel.
2. The area throughout which they permit travel.
3. The technology that they employ.

An integrated ticketing scheme may be classified according to the **mode of transport** to which it applied, e.g.:

1. Bus & Rail Schemes – e.g. PlusBus was the first British national integrated ticket to link the bus and rail modes.
2. Air& Rail Schemes – e.g. Airrail in Germany or Flugzug in Switzerland.
3. Others Including Multimodal Schemes - combinations of a variety of modes – bus, tram, light rail, heavy rail and metro.

Integrated ticketing schemes can be also classified accordingly to the **area of travel**. Then, fares depend on two main elements: the type of traveller and the range and duration of the journey. Travellers may include the following, or further subdivisions of these depending upon age:

1. Unaccompanied person.
2. Elderly person.
3. Person with disabilities.
4. Student.
5. Unemployed person.

Journey definitions may include:

1. Travel zones.
2. Demarcation lines.
3. Maximum time durations.
4. With, or without, connections.
5. Multiple use on the same, or different, days.

Clearly, combinations of these are possible and are often found (Scottish Executive Social Research, 2004).

Another criteria of integrating ticketing classification is a **technology**. Tickets appear in a variety of shapes and sizes and are obtainable from a range of outlets, but they can be divided in to those that are entirely passive and those which can be required to supply information automatically. So generally, the integrated ticket product can be delivered through paper tickets or smartcards.

Passive tickets are variations on a pattern which has been in use for decades – a piece of paper or cardboard that usually bears details of the journey, such as origin and/or destination, date of travel, fare paid and perhaps the class of travel. They may be almost any size, shape or colour and be sold manually, or by vending machine, or printed from an Internet transaction, but the common feature is that all require manual intervention to determine validity.

A consideration of electronic ticketing is closely connected with smartcard technology. Smartcard integrated ticketing reduces boarding times of passengers and provides highly accurate passenger-trip information. The information provided with smartcard systems can be used for patronage monitoring and network planning.

Truly smart cards are the latest refinement in a series of electronic ticketing methods that began with magnetic stripe cards in London in 1964 (Turner & Smith, 2001). Although technologically simple and cheap to produce, these hold a relatively small amount of information, are easily read and copied and are not re-programmable. They are thus relatively insecure. The incorporation of an electronic memory chip confers the facility to hold value on the card, and to include more effective security features, but such cards cannot be re-programmed and when their value is spent, their use comes to an end.

Tickets equipped with microprocessor are other type of electronic tickets. Incorporating a microprocessor together with a memory, however, renders the card re-programmable, which not only means that its monetary value can be increased, but also that other information can be stored or exchanged if the card is inserted into an appropriate reader.

Additionally contact-less smartcards should be mentioned. They permit access without physical contact with a card reader. Instead, the reader gains access to the card's data by emitting radio signals which are received by the card's inbuilt antenna that facilitates two-way information exchange with the card's memory. (Schlumberger, 2003). This can include validation procedures and access controls. Furthermore, such cards can be powered by induction using the reader, which extends the useful life of the card.

Usually, smart ticketing term is used where the ticket is stored electronically on a microchip, commonly contained in a plastic smartcard. Tickets are checked by presenting the smartcard to a smart reader (Smart and Integrated Ticketing Strategy, 2009). Smart ticketing infrastructure can facilitate better integration, but does not guarantee it. However, to install smart infrastructure without further integration would not realise all of the potential benefits on offer. This ticket is then passed over a reader on the vehicle, which deducts the appropriate fare. Often the passenger is required to "tag-on" the vehicle when boarding, and "tag-off" when getting off. This allows for accurate fare calculation, and requires no input from the driver/guard (NZTA, 2008).

The example of implementing integrated Smart Card Ticketing is the Greater Dublin Area. The system is being introduced on a phased basis, based on smart card technology, over the period to 2011. A progressive approach is being adopted to allow customers to familiarise themselves with using the new system and to permit transport operators to undertake the necessary replacement of magnetic strip technology, the testing of smart cards and the integration of the various technologies involved (Integrated ticketing system, 2010).

THE EUROPEAN UNION TRANSPORT POLICY REGARDING INTEGRATED TICKETING

Sustainable intermodal passenger transport has been already included in the European Union transport policy. It considers convenient connections between different modes, generating impact on the modal split and encouraging the use of alternative modes to a car. Besides it takes into account also wide range of conditions such as environmental aspects, road safety, security or congestion. It features such elements like integrated ticketing, but also travel planning, stimulation of collective passenger transport and its quality of service.

Passenger intermodality has been put on the agenda in several European policy documents and more or less in national or regional policies. As early as 2001 the European Commission identified integrated ticketing, baggage handling and continuity of journeys as priority for passenger transport in the Transport Policy White Paper. In its part "Placing users at the heart of transport policy", the White Paper encourages the adoption of integrated ticketing between transport operators of the same sector and also between different transport modes in order to facilitate the transfer of passengers from a network or transport mode to another. In so doing, the Commission pursues a dual political goal: on the one hand, it ensures a widened choice of transport services for the European citizens by meeting their need for mobility; on the other hand, through better information on travel options by prompting the European citizens to make better use of the existing infrastructure when travelling, including more environmental friendly modes of transport, with a view in particular to fighting congestion and environmental nuisance within the European transport system (EC, 2008).
As a follow-up of the White Paper, DG TREN put also priority on activities in the freight sector with the development of the MARCO POLO programme as one of the best examples (Link forum brochure, 2009).

In 2004 the EC commissioned a study ‘Towards passenger intermodality in the EU’ which has been a basic report putting priorities from a European Policy perspective forward (EC, 2005).

The Commission Communication "Strengthening passengers rights within the European Union" (EC, 2005a) notes that the passengers' right to integrated ticketing is not yet acquired:

> "It should be a simple matter for passengers to combine several modes of transport in one journey, but the traditional method of organising transport by sectors constitutes a barrier to intermodality. The traveller is too often dissuaded from combining different means of transport for the same journey and encounters difficulties for example in obtaining information and ordering tickets where the journey involves different modes".

The Communication announces the intention of the Commission to bring together representatives of rail companies and airlines in order to obtain a voluntary undertaking from them to set up an integrated ticketing system. This document is a step in that direction.

In June 2006 the EU organised a Mid-Term Review of the Transport White Paper (EC, 2006) with the following key points: maintenance of a high level of mobility, attention to environmental protection and energy security, innovation for efficiency and sustainability and international connection beyond the EU. A new concept was also introduced: comodality. Comodality stands for the optimisation of each mode (clean and efficient) and integration of modes for seamless transport, thus provoking modal shift.

Thereafter, also the EC Action Plan on Airport Capacity was launched in January 2007 (EC, 2007), urged by the statement that 60 airports would be heavily congested by 2025. Some capacity can be freed if some of the short-haul flights can be shifted to rail and with improved air-rail intermodality. Then airport access and especially rail links need to be improved. The European Commission is promoting rail links from airport to cities and regions, with funding for intermodal infrastructure (TEN-T, European Regional Development and Cohesion Funds). The annex to the communication contains a fourteen point action plan. The eighth point says:

> "The Commission intends to encourage integrated air-rail ticketing and will publish a consultation paper on the subject".

In 2008 the EC issued public consultation document of the European Commission "Development of integrated ticketing for air and rail transport" (EC, 2008). Based on the hypothesis that integrated ticketing can be an important factor to generate demand for intermodal air-rail services, the objective of this document was to examine the organisational and technical opportunities related to the sale and promotion of such services and to open a debate on a voluntary engagement of the concerned stakeholders for the development of integrated ticketing as announced in the communication on passenger rights and reaffirmed in the communication on airport capacity.

In the EC-communication "A sustainable future for transport" of June 2009 (EC, 2009), the main outline for a new White Paper at the end of 2010 was sketched. In this new White Paper there will be three priorities: people, integration and technology. The communication included a strong statement on the integration of modes:

> "(We) strongly believe that meeting the future challenges will require focusing on new technologies and on the integration of the different transport modes into a single system, all this in a more integrated internal market in which competition is fully granted."

Also in the field of **urban transport** there are a few European policy initiatives with strong links with intermodality. In 2007 the Green Paper on Urban Mobility was coordinated, titled "Towards a new culture for urban mobility. Ultimate goal was to optimise the use for all modes of transport and to organise comodality" (EC, 2007a). In 2009 this work was elaborated by the Action Plan on Urban mobility which includes some important topics for intermodality: improved information, passenger rights, integrated planning, greener transport, sharing experiences and extra funding (EC, 2009a).

For some specific issues, it is important to mention further EU initiatives. The Action Plan for the Deployment of Intelligent Transport Systems of 2008 was originally started as a road-only exercise but now also covers interconnections with other modes (mainly public transport). The links to intermodality are quite obvious when taking a look at some action themes: development of a Europe-wide real time traffic and travel information system, promotion of multimodal journey planners, attention to privacy and liability issues, urban and inter-urban interfaces (traffic management) and the development of a decision making toolkit.

In the field of passenger rights the Commission passed Regulation 1371/2007 Rail Passenger Rights and Obligations which gives a very practical approach to intermodality, although quite softened by compromise. For example Article 5 states that railway undertakings must enable passengers to bring bicycles onto the train, where appropriate for a fee, if they are easy to handle, if it doesn't adversely affect the specific rail service and if the rolling stock permits it (Link forum brochure, 2009).

A number of EU-research projects regarding interconnectivity issues, strategy, operations and design, technology as well as standardisation activities have been carried out in the passenger domain.

Finally the comprehensive list of relevant projects and activities, funded by the European Commission could be given as a reference for further establishment of the European Union policy framework in regard to integrated ticketing:

CIVITAS Intermodality in urban areas (2002-2009),
www.civitas-initiative.org

Towards European Passenger Intermodality (2004),
www.eu-portal.net

MODAIR Measure and development of intermodality at airports (2005-2006),
www.eurocontrol.int

Air and Rail Competition and Complementarity (2006),
http://ec.europa.eu/transport/air/studies/internal_market_en.htm

eMOTION Europe-wide multimodal on-trip information (2006-2008),
www.emotion-project.eu

LINK - The European Forum for Intermodal Passenger Travel (2007-2010),
www.linkforum.eu

KITE Knowledge Base on Intermodal Passenger Travel (2007-2008),
www.kite-project.eu

INTERCONNECT - Interconnection between short and long-distance transport networks (2009-2011) www.interconnect-project.eu/

iTRAVEL Personal Travel Assistant for seamless journeys (2008-2009),
www.i-travelproject.com

IFM Project Interoperable Fare Management (2008-2010),
www.ifm-project.eu

WISETRIP – Wide scale network for multi-modal journey planning (2008-2011),
www.wisetrip-eu.org

CURRENT PRACTICE AND ADOPTED SOLUTIONS

There are three types of integrated passenger transport connections which adapt common ticket idea in Europe. Europe is highly urbanized area and its transport characteristics differ from those of the US and many other countries. They are probably to some degree similar to characteristics of other high-density populated areas (like Japan or Taiwan). Within EU in particular three types of integrated passenger transport solution could be found. metropolitan, regional and interregional.

Characteristics of the first type apply to all integrated transport schemes which are one city oriented. Usually this type of integration is build around two zones - area within the city (inner transport system) and area in its close neighbourhood (external transport system). The integration here serves the needs of the city, area around gravitates towards city as it is major administrative economic, cultural centre, therefore solutions proposed consist mainly of daily commuter type. In the EU this type of transport system could be found in capital cities and sometimes other major cities of member states. Different level of organization witnesses regional transport integration. Here we have rather number of cities of equal or close to equal capabilities than one centre of gravity. Regional integration creates more balanced transport system in a way that interests of different urban areas (and their populations) are taken into consideration while organizing it. In Europe there are some examples of such areas – usually build around highly populated industrial regions of countries.

Finally there is an interregional type of integration in passenger transport. Main aim of this integration is to provide user with comprehensive service allowing to reach destination point within particular city with ease. It is a solution which integrates long-distance mode (rail, maritime, air) with internal city transport system (bus, metro, tram). This type of integration is most difficult to introduce and just few existing practical solutions in Europe show its potential.

One other important factor has to be considered – not always transport system integration means automatic introduction of common ticket for different service providers. To the contrary European evidence tells that often it is easier to build expensive new infrastructure and improve technical interconnectivity than to change organizational patterns. It is hard to achieve in case of horizontal integration across the modes, but even when major operational

obstacles caused by use of different mode are not present i.e. if integrated solution is being sought within one mode only, still not many successful cases could be identified.

Metropolitan areas

Majority of success stories could be found within metropolitan areas. Cities with greater ease accept common transport solutions as compared to bigger administrative units like regions. Urban areas with more than one city are more difficult to integrate than urban areas centred on one major and dominant city. For those reasons probably the best thought out solutions could be found in biggest EU cities and their metropolitan areas.

Zone system

Example of well working system could be found in Torino in Italy. The city has introduced so called FORMULA system. It is an integrated ticketing system established by the Province of Turin since 1996, in accordance with the Piedmont Region, the municipality of Turin and 28 local public transport companies operating in the covered area. The system covers both bus and rail modes and user could choose any bus or train operating within designated area. The ticketing is based on pre-purchase of a weekly, monthly or annual subscription.
Area covered extends from the city of Torino center in concentric rings as far as 40 km outside. The whole area is divided into 19 zones in which the city of Turin represents the urban area and the municipalities immediately closest constitute the sub-urban area. Accordingly to OECD Turin metropolitan area could be inhabited by as many as 2.2 mio people (OECD, 2006).

The system is build around urban and suburban networks (1 metro, 8 tram lines and 100 bus lines operating 100 km of tramline network and 1,000 km of bus network) supplemented by out-of-town bus network (73 bus lines operating 3,600 km) and rail network (2 lines in concession covering 82 km and 1 line managed on behalf of the Italian Railway company, Trenitalia, covering 24 km) (GTT, 2010).

Ticketing is based on fare system differentiating between: ordinary city ticket (€ 1,00) which is valid for 70 minutes from when first punched on metropolitan lines and on city rail links along GTT suburban lines, all-day city ticket (€ 3,50) which also can be used on metropolitan lines and on the city rail links along GTT suburban lines. There is also special all-day city shopping ticket (€ 2,00) valid for any 4-hour period on metropolitan lines and on the city rail link. Additionally there is ordinary city + suburban ticket valid for 70 minutes for € 1,50 which allows user to use all city and all suburban network.

Integration of tickets within one city could be achieved with relative ease. There are no to many entities to be involved and if rail link is integrated it is simply operated by city transport provider on lines which serve city. This solution allows to avoid problems with revenue distribution and organizational issues. It has however also some deficiencies – system could work for the city metropolitan area but it will not be easy to extend it to the region. Rail

companies will not participate in mass scale pass of management function to the municipality.

Another Italian example is a system based on Rome and called Metrebus. It might be considered regional rather than metropolitan system by design as it extends to the whole Lazio Region, in the centre of Italy, however due to Rome's size and importance for the neighbouring areas it is in practice one city oriented system which serves this city needs. The Region has been divided into fare zones (Zone A for Metrebus Rome and Zones A to Zone F for Metrebus Lazio). If the travel has as initial or final destination the Zone A (the city of Rome) an additional zone is to be considered. The system is operated by Cotral SpA, Atac SpA, Trenitalia SpA and Met.Ro. SpA. The involved means of transport are buses, trolleybus, trams, undergrounds and railways.

FARES

There is a single fare structure and ticketing system in place - one ticket for bus, tram and metro. The ticketing system is divided into Metrebus Roma which refers to the range of tickets for travel within the city and Metrebus Lazio which covers travel into the outer suburbs There are following integrated tickets available (Atac, 2010):

1. BIT - Integrated Single Ticket (1 EUR)- ticket for one journey up to 75 minutes travel on all ATAC buses and trams or the urban routes of COTRAL buses as well as the metro and COTRAL trains and trains within the city limits.
2. BIG - Integrated Daily Ticket (4 EUR)- the day pass can be used for unlimited rides until midnight on the day on which the ticket is validated. It is valid on ATAC buses and trams, COTRAL buses in the city limits, plus the metro and COTRAL and trains within the city excluding airport destination.
3. BTI - Integrated Tourist Ticket (11 EUR)- ticket is valid for three days travel on buses, trams, suburban trains and the metro. For whole week Integrated Weekly Pass is used insted with cost of 16 EUR. There are also monthly passes: personal (30 EUR) and transferable (46 EUR)
4. Lazio Regional Tickets - tickets cover travel over a wider region (Rome and Lazio). There are daily, weekly and monthly passes available.

As with Torino Rome system is well integrated and offers users variety of options. The travel ticket allows for mostly seamless trip and system works efficiently.

Traditional and integrated tickets at the same time

Different approach has been used in Poland's capital – Warsaw. Warsaw city transport is conducted by City Transport Management Board (ZTM- Zarząd Transportu Miejskiego). For internal city transport bus and tram systems are used and there is separate WKD rail company (Warsaw Rail Company) which provides commuter service to the city and its neighbouring area. In Warsaw integration of ticketing within this traditional framework does not really exist. Although there is one ticket for tram, bus and metro transport it is only because all those means of transport are managed by the same company. Also what is important common ticket for all those modes applies only to selected time tickets (daily,

monthly) while fare for each trip is paid by purchase of separate ticket for each of them. But Warsaw is also an interesting example of cooperation between different providers in regard to external zone. This is area which is on the outskirts of the city and includes neighbouring (much smaller) cities. Here an integrated ticket combining rail operator and city transport operator has been introduced.

Warsaw system distinguishes between inner city and agglomeration. Within administrative boundaries and up to 10 km outside only city integration is in effect (tram, bus, metro). Alongside there is a common ticket initiative which encompasses above plus rail in Warsaw and in the area around Warsaw operated by two companies: Mazovian Railways (Koleje Mazowieckie) and PKP Regional Railways (PKP Przewozy Regionalne) Same tickets are used as in city internal transport system (but only some types of those are honoured on trains). There is a zone system in effect which is a complicated scheme of zones and tariffs – not easily usable for outsider (but accordingly to users no problems for passengers when they get used to it on daily basis).

On the technical side common tickets could be in form of Warsaw City Card (tickets are coded in electronic card for all tram, bus, metro and WKD). For internal transport there is one managing authority - City Board of Transport – organizer of bus, tram and metro transport services within Warsaw city who issues those cards. External area under common ticket agreement is in addition to this provider operated by:

1. Mini- bus companies servicing area around Warsaw.
2. KM - "Koleje Mazowieckie - KM" Sp. z o.o. –railway company
3. WKD - Warszawska Kolej Dojazdowa Sp. z o.o. – railway company.
4. PKP Przewozy Regionalne (on some trains) – railway company.

Important side note is that rail operators KM and WKD are both regional level, although KM tries to compete in other voivodships of Poland (voivodship is NUTS II territorial unit in Poland) than Mazowieckie – home to the Warsaw city - but this is not strong presence externally. Different story is with PKP Przewozy Regionalne – this company is country level organisation. It operates in all voivodships of Poland and is one of the two biggest companies who dominate market. Therefore their inclusion into common ticket was conditioned by selection of trains to which common ticketing applies. In particular trains which are designed “interregio” connecting to other voivodships could be part of a deal (KM 2009).

Only some tickets are accepted on rail, e.g. 90-day ticket, 30-day ticket (but only network tickets - excluding one line only tickets), 24 hour ticket, 3-day ticket, 7-day ticket, 14-day ticket and special tickets for seniors. What is important is a fact that there is no common ticket for single ride which shows that whole concept is designed to serve regular daily commuter not a long distance travel (ZTM Warsaw, 2009).

There are certain operational problems associated with use of common tariff. Regular daily ticket could be activated on normal basis (in automated machines which are located on bus stops, metro entrances). However if passenger starts its journey on rail – has to activate ticket by contacting staff of the train and it is done via signature of responsible staff member.

More complicated is situation when longer time tickets are considered. Than activation is done by train staff member with use of electronic device which records date on magnetic strip of the ticket. This is later used by any control officers on bus or metro to check validity of the ticket.

Systems designed to increase gravity towards particular city

Another city based solution is planned for the city of Wroclaw. This is example of one more network being developed to serve internal city needs. Adopted plan of public transport development is based on transport integration strategy based on 2001 Strategy of Wroclaw Agglomeration Development and is centred on principles that (Friedberg and Komar, 2008):

1. Agglomeration area is to be serviced by integrated transport system.
2. Public transport system is to be competitive against private transport.
3. System should be based on rail and tram primarily.

Wroclaw integrated transport development plan consists of two stages. In the 1st stage integrated tram system is to be introduced to serve inner city (within city administrative area). 2nd stage extends this to neighbouring area and is based on rail mode. Wroclaw Agglomeration Rail System (WKA) should link voivodship with Wroclaw internal city transport network. One ticket for passengers travelling from/to city metropolitan area (by rail) and within the city (by tram) is planned.

Regional solutions

Conurbation systems

Only couple of examples of such solutions could be found around EU. One of the best systems works in Polish Silesia region. This is traditional industrial region of Poland with high concentration of coal mines and metallurgy. The cities of the region created communication union with aim of provision of transport services to its inhabitant. At present there are 23 municipalities that belong to the Union: Katowice, Bytom, Bobrowniki, Będzin, Chorzów, Czeladź, Dąbrowa Górnicza, Chełm Śląski, Gierałtowice, Gliwice, Imielin, Knurów, Mysłowice, Psary, Radzionków, Ruda Śląska, Siemianowice Śląskie, Siewierz, Sławków, Sosnowiec, Świętochłowice, Wojkowice, Zabrze.

The range of activity of the Union includes the total area of 1,4 thousand square kilometres, with over 2 million people living there. The fare sysytem is simple. There are three types of charges – one, two and three or more zone ticket. Regular tickets (price of which is set at around 0.4 EUR to 1 EUR depending on number of zones considered) could be purchased in many booths selling tickets. There is also a possibility to purchase single fare tickets in buses or trams, regardless the number of zones travelled price will than equal three and more zone ticket. There is selection of monthly tickets. Options extend to purchases where (KZK GOP 2009):

1. The holder is authorised to ride all bus and tram lines within one selected town (municipality) (price amounts to c.a. 25EUR).
2. The holder is authorised to ride all bus and tram lines over the entire network(c.a 29 EUR).
3. The holder is authorised to ride all bus lines or only tram lines within one selected town (municipality)(c.a. 22 EUR).
4. The holder is authorised to ride all bus lines or only tram lines over the entire network (c.a. 26 EUR).

There is also a variety of tickets which could be transferred to other person. Those include: 24-hour, 48-hour, 5-day, 7-day, 14-day and monthly. Also tickets valid for one specified holder only could be purchased in variety of: 3-monthly (valid for three consecutive months) authorising to ride in two or more towns (municipalities) and 3-monthly (valid for three consecutive months) authorising to ride in one town (municipality).

Metropolitan plus regional system

Those systems under normal conditions would be similar to single city gravity centre systems but because there are more than one city of importance in centre they impact region differently. While considering geographical location those systems are also close to one-city agglomeration systems, but again due to equal rank of cities included different intra-regional links are developed within them. An example of this type of system could be found in Poland. Tricity is an area in northern Poland on the Baltic coast which covers cities Gdansk, Gdynia and Sopot. Due to continuous expansion of especially Gdansk and Gdynia other nearby cities and towns are sometimes included into this regional centre under term ”Tricity”.

Common ticket idea for this agglomeration is based on political declaration of March 28, 2007 on Tricity Card. In practice there are two different ticket integration policies for internal and external area. Internal area (Gdynia – Sopot – Gdansk) has common train ticket with separate tickets for bus and tram services for Gdynia and Gdansk. Sopot does not have its own service provider. Transport services are conducted by both Gdansk and Gdynia municipal companies designated to the task. External area to be integrated into common transport system reaches as far as Slupsk / Wladyslawowo / Hel to the North and Tczew to the South. It’s largest length is c.a. 160 km. The idea for integration of the Tricity transport network has been discusses since 1970’s. However due to Gdansk and Gdynia competition (both are ports and this creates rivalry) has not materialised until recently (2007).

The current system is considered only first step towards common ticket introduction and it has at present many limitations. There are number of types of common tickets. First option is a “all non – rail systems” allowing user to travel via bus, trolley and tram within Gdansk, Gdynia and Sopot. Then there is a so called “ticket of two operators” which could be SKM (rail rapid transport) on section Luzino-Cieplewo – so effectively covering all of Gdansk, Gdynia, Sopot and additional sections north and south plus any one of the three Gdansk or Gdynia or Wejherowo municipal providers (each of them for all means: bus, trolley and tram). The third option is broadest and consist of SKM plus all three city operators (MZKZG, 2009)

Of course differentiation of fares is in effect. The 24h ticket for example costs for the first option 12 PLN (c.a. 3.1 EUR), the second 15PLN (c.a. 3.9 EUR) and the third 18PLN (c.a.4.6 EUR). Similarly monthly ticket cost is differentiated with: 120 PLN (c.a. 31 EUR) for option one, 170 PLN (c.a.44 EUR) for second and 200 PLN – third (c.a. 51 EUR). No other differentiation (like weekly or 2-day ticket) is available. This highly reduces possibility for choice. In fact use of common ticket is also handicapped by fare amount. In reality for this tariff to be competitive against purchase of separate tickets for all operators, customer has to change provider at least 5-6 times per daily trips which is seldom a case for majority of area inhabitants. Most daily commuter travel follows a pattern of use of 2 operators (which gives four trips per day).

The fare is so high mainly due to internal problems with division of revenues between service providers involved. In fact there is no system which records usage of particular mode therefore it is hard to arrive at exact share of revenues which should be allocated to the companies in question. Nevertheless it is considered only first stage of ticket integration and amendments to the system are planned. First 2-3 years were from the start considered testing period which should provide answers about the efficiency of the system. Currently apart from need for better schedule interoperability there are plans for extension of this system to reach as far as Slupsk in the North-West and Tczew in the South ("extended" Tricity area of length of 160 km) and plans for integration of water trams into the system (thus extension to Hel – in straight line distance Gdansk – Hel is 33 km through the Bay of Gdansk).

City based system regionalized

Another example of positive solution although still one suffering from obstacles is the consortium UNICO Campania – a body composed by 14 local public transport companies, operating both rail and bus services. The UNICO system shows how a city centred system (originally designed for Naples) could evolve to serve regional needs. When the integration was first launched (1995) area covered encompassed only urban part of Naples. In 2000 it was extended to other 43 municipalities, in 2001 further extension brought that number to 162 municipalities and from 2003 system serves whole Campania Region and provides services for more than 5600 th. Inhabitants.

The applied fares are divided into urban fares (UNICO NAPOLI) and extra-urban fares (Fare U and Fare E). The first one applies to journeys within the urban and sub-urban area of Naples, second covers trips between a municipalities of the Campania region and the city of Naples, while last case applies to travel outside Naples amongst the remaining municipalities of the Campania region. The three major fares are further divided in accordance with zoning system introduced (11 zones altogether). The actual ticket price depends on combination of zone and any of the three basic fare types. For example price ranges from 1.1 EUR in UNICO-NAPOLI for a single ride to 3.1 EUR for daily ticket with possibility of monthly or yearly subscriptions (respectively 36.7EUR and 251.5 EUR). U and E fares range from 1.1 EUR for zone 1 up to 8.6 EUR for zone 11 (UNICO CAMPANIA, 2010). There are also possibilities for purchase of monthly or yearly subscription.

The system integrates two modes: trains and buses, and allows for unlimited number of daily/monthly/yearly trips within zone boundaries. The key element of the technical side of the enterprise is magnetic card. For any possible discounts (annual student and aged people subscriptions) more advanced contactless smart cards are in use. It is perceived that in following years all types of subscriptions will be done in the form of smart cards. Furthermore, the implementation of a central Elaboration Data Centre (CED), which will be connected with the local Elaboration Data Centre of each transport company is planned. The central CED will process the information on ticket sales and on obliterated tickets in order to compute the revenues and to divide them among different carriers on the basis of the carried passengers.

This solution will be remedy for most important barrier preventing tariff integration – problem with revenue distribution. In traditional systems (as currently still in Campania) distribution of the revenues is made accordingly to:

1. Usage of the particular vehicle (via counting and statistical extrapolation of results),
2. Usage of the different tickets/subscriptions.
3. The “fare evasion” rate per transport company, corresponding to the percentage of people who do not pay the ticket for using local public transport.
4. By recalculation per mode and per company of the fare related to the average trip length (expressed in km).

In case of Campania currently system allowing for calculation of revenues of particular company derives this number from combination of inputs : passengers, “fare evasion” rate and recalculation method. This is a complex system which although is believed to be close to real usage may rise a questions as to efficiency of its use. Firstly it is not “easy to follow” system thus planning for companies involved is hard as they cannot easily predict future income. Secondly method demands that all companies use the same counting standards. And there are always questions as to the validity of selected sample. Introduction of smart cards will alleviate most of those issues.

Also important question is one about fare level – it should not be higher than for separate purchases of tickets on particular sections. With so many operators involved as in Campania region it is sometimes hard to achieve. To add to this problem in some cases a higher than expected number of journeys have been reported per person thus actual usage is higher than what was originally perceived.

Possibilities of modern technology

Integrated ticketing system was adopted by the Italian province of Bolzano in 1997. It extends over 116 municipalities, with potential users estimated on more than 0.5 mio people. From organizational side special consortium has been created STI (Servizio Tariffario Integrato) – *Integrated Service Ticketing* by the 27 local public transport companies.

The system is based on urban and extra-urban bus services under the management of the Province of Bolzano Authority, rregional trains (including connections reaching as far as the city of Trento to the South and up to the city of Innsbruck to the North), The Mendola Funicular; railways of the Renon, San Genesio, Verano, Meltina e Maranza. Furthermore on the provincial railways (Val Venosta, Val Pusteria, Alto Adige) the interregional, national and international tickets emitted by Trenitalia are allowed.

On the technical side tickets are distributed by electronic machines compulsory in each vehicle. Machine recognizes previous magnetic stripe information and calculates automatically the cost of each journey. Collected data are transmitted in real-time or at the end of the service to a central server that calculate the revenues of each company member of the integrated system. Currently there are 625 buses equipped with electronic ticketing machines and on the Val Venosta trains a ticket vending machine has also been installed. The 45 train stations in the network are equipped with 2 or more electronic ticket machines and at least one ticket vending machine (STI, 2010).

The fares of the STI system are distance-based. The passenger must validate the ticket on each vehicle (bus, train, etc..). The main feature of the STI is the pre-paid card named “Carta Valore”, which costs 5 or 10 Euros. The fare of urban trip is 0.65 €; this amount is deducted from the total amount of the Carta Valore each time a trip is made. The fare of extra-urban trip is 0.65 € plus 0.065 € per km (STI, 2010). The total amount of the fare to be deducted from the Carta Valore is calculated automatically by the bus driver (by using a special software), which is informed by the passenger about the final destination. In the train stations passengers can type in the code of the destination stop. The same Carta Valore can be used contemporarily by up to 9 users.

The distribution of the ticket revenues is based on the passengers really carried by each single company. This is possible because the on-board ticket machine installed on the vehicle recognizes the operator from which the ticket has been bought. The revenues are then distributed to each operator accordingly with the km “consumption” per each ticket, by applying a compensation criterion.

During the implementation period the most important problem was the opposition of some transport operators to the application of electronic ticket machines. Since the system is in operation for 15 years its efficiency could be tested. In financial terms operational costs are about 2,5 million Euros per year including maintenance, personnel and information system for passengers. In 2009 the revenues were 21 million Euros.

Rail centred regional schemes

Although majority of regional integrated tickets evolved from city based metropolitan transport systems there are some different examples. In German regional transport interesting example of integration is one day pass for Saturday or Sunday for five people to use all regional trains and many other public transport services all over Germany. The responsibility for regional rail transport lies with regional authorities. When this scheme has been introduced for the first time it attracted as many as 10 mio customers in the first 12

months. The offer constitutes a one day pass for small groups to travel by rail at a bargain price (15 DM = 7,67 € for five people, valid Saturday and Sunday) (DB, 2010a).

As local trains are financed with a major part by public money and not by sold tickets, offering tickets at bargain prices in off-peak-times (weekend) generates additional revenues at marginal costs (trains were running anyway). This in turn had profound impact on the whole German rail system. Idea behind the tariff was that it should be used for regional one-day excursions at the weekend, but many people used the ticket for long-distance trips across whole Germany, irrespective the very long travel-times and high number of necessary train changes. This brought a massive overload to regional trains while faster long-distance trains, run by Deutsche Bahn were losing passengers and revenue. This in turn led to increased prices and the introduction of Ländertickets of limited regional validity.

Länderticket is based on one day passes (for 1 person or 5 people) for all regional trains and most public transport in a specific Federal State (or group of smaller States) in Germany.
Compared to its predecessor Ländertikcet has larger intermodal validity but on a more regional scope. To implement the intermodal validity of these train tickets in local transport numerous negotiations which every regional transport authorities concerning the breakdown of ticket revenues were necessary. In terms of economic efficiency form about 10 mill tickets sold per year the estimated revenues are at about 250 mill. € (DB 2010b). Also additional social effects should not be neglected – promotion of public transport which for train users under this scheme became more comfortable, easy and significantly cheaper while strengthening the competitiveness value of public transport vs. private car.

Inter-regional solutions

Inter-regional integrated transport services are hardest to implement. Practice of their introduction shows that if they are even designed they are partial solutions only. There are really few cases of successful use of this type of common tickets for longer time periods.

Long distance rail and city public transport integration

There are 3 types of BahnCard offering 25, 50, or 100% discounts on rail charges throughout Germany. The customer can book either 1st or 2nd Class for each discount level. To be entitled to free public transport services, customers must have a Deutsche Bahn AG long-distance ticket with BahnCard discount which means, for a distance of at least 100 km. City-Ticket entitles customers to continue their journey by bus, S-Bahn, tram or underground from their station of arrival to their destination within the urban area in more than 80 cities in Germany. The offer is valid both for the outward as well as for the return journey at the destination of the outward journey for certain local transport zone. City-Ticket was developed jointly by Deutsche Bahn AG and the Association of German Transport Companies (VDV) to enable rail passengers to use both intercity and local transport using only one ticket. Each transport provider is responsible concerning only for his part of the transport chain.

Long distance rail and air transport integration

Integration of two long distance modes is real rarity. The solutions of this type are only found in rail-air or rail-maritime modes. Within EU the longest in operation is German Rail&Fly programme. Its major component is air ticket with add-on ticket for train usage from any railway station to any airport in Germany and vice-versa, including foreign airports Basel-Mulhouse and Amsterdam. These tickets are sold by the airline (for the time being 80 participating carrier) or tour operator (76 participating companies/brands) when purchasing the air ticket or the package tour respectively. While some airlines / tour operators include these tickets in the air fare / price of package tour, others charge the customer when applying for a Rail&Fly ticket with a fee of 25 EUR (Lufthansa 2010). Rail &Fly includes transfer between railway station and airport by public transport if there is no direct rail service to the air terminal.

As for economic validity of this project it can be estimated that 3 - 5 mill. Rail&Fly tickets are sold per year today. The way this plan was introduced in Germany shows what type of operational problems exist in integrating rail and air modes. When originally these Rail&Fly tickets were sold by Deutsche Bahn, its staff on board of the train had to check, if the customer had actually bought airline ticket. The problem here was that some customers were unaware of the check and discarded used air tickets. Other problem was that rail staff had to have good orientation as to the number and names of participating partners. In times it created to many difficulties for rail operator. Currently sales distribution has been handed over to the airlines / tour operators supplemented recently by introduction of internet booking option. Another problem is possible abuse of the system by passengers who travel before actual departure date.

The revenues of Rail&Fly are for Deutsche Bahn. The benefit for the airline is to offer seamless ticketing to their customers to/from their origin / destination of travel. Considering price difference between air and rail modes it is sound solution. Valuable especially for airlines which are not co-operating with Lufthansa / STAR Alliance, so that rail travel to/from the airport substitutes necessary short-haul feeder flights.

Another solution of the type is AiRail ticket which combines train travel from Cologne, Bonn and Stuttgart to Frankfurt Airport with a Lufthansa / STAR alliance flight from Frankfurt to any destination worldwide. Different to Rail&Fly the passengers are to check-in already at the railway stations in the cities mentioned and use the train (exclusive designated seating area) with their air ticket (DB, 2010c).

This particular scheme replaced Lufthansa own specially designated train which had been not economically viable. Trips on these Lufthansa "flights" can be booked via the usual reservation. Usually as a feeder to/from intercontinental flights. Passengers check in at the railway stations.

Ticket prices are calculated similar to feeder flights, i.e. using these train as a feeder may be without additional cost for intercontinental tickets or charged on base of IATA-mileage tariffs, separated by business / economy class fare categories. Deutsche Bahn gets an fixed revenue from Lufthansa. Lufthansa gets the revenues from ticket selling. From the customer

point of view it is almost perfect solution, although different modes are used there is only one responsible contact: the airline.

CONCLUSIONS

An overview of European solutions in regard to integrated ticketing practice shows that introduction of such a schemes is often difficult and faces many barriers of technical operational and social nature. As EU report on passenger intermodality sums it up:

> The feasibility of integrated ticketing becomes a major problem as a result of the many transport environments and differences between these environments. Air carriers, national railways, regional and urban public transport operators all have different fare policies and models (e.g. time, zonal and distance related), together with different subsidy models. This makes universal tickets a difficult proposition without (EC, 2004).

Charges and revenues

Other problems encountered in regional system development are “optimal fare” choice. From the company point of view the integrated fare should have not let the revenues decrease and from the users perspective the new fare should have not been higher than the previous one. This is for instance not the case found in all examined cases (e.g. Tricity and sometimes is hard to balance in Campania example).
This is always a problem with systems based on distance zones and not time or number of modes used and should be expected under theoretical research on “public goods” nevertheless problem exists for monthly and annual tickets in majority of examples. Daily routine usually prevents people from overuse, the situation changes when average monthly use is calculated by companies (as it is believed that people will stick to some average – practice shows that on weekends they start to travel extensively)

Sometimes opposite takes place - the annual subscriptions are too much discounted in comparison with the actual number of journeys. This contributes to a decreasing of the company revenues.

Social acceptance

There is a need of a stronger enforcement, in order to avoid a massive evasion of the ticket payment. “Free rider” phenomenon is frequent in integrated transport systems as there is an ease of switching to another mean of transport if control is noticed. Electronic control instruments like gates could be bypassed and human control means cost increase.
In case of Campania massive evasions have been noticed with many users avoiding actual payments. In Tricity this problem has been largely solved by extensive controls (but it has also a negative impact as too frequent control has low social acceptance and actually forces users out of the public transport system). There are also severe doubts about introduction of

smart electronic tickets. Those tickets allow to track the passenger and learn a lot about his travel habits but also about his daily routine and behaviour. It raises questions about privacy protection and citizen's rights. Even if data is not stored for long time periods people fear that with electronic devices governments might exert control over their actions. Given the nature of electronic data recording it is still possible to recover data after deletion – and populace is aware of this feature of the system.

Political will

Integrated transport connections could be limited depending on individual awareness of local transport authorities concerning the general idea of intermodality, financial threats (cannibalisation) and opportunities (additional customers). Political decisions are also necessary in regard to financial side of the possible projects. Integrated ticketing demands significant investments in technical equipment (and not only transport vehicles but also IT systems have to be developed). Public transport in majority of countries is subject of government (central or local) care. Therefore financial burden of new integrated connectivity will certainly be placed on the state.

Technical aspect

With the advent of new electronic devices like smart cards, electronic charge collection, satellite systems it is easier to overcome barriers in integrated ticket introduction. Smart cards for instance might alleviate problem of revenue distribution between participating companies because they make it possible to count each passenger.
Electronic control devices and satellite navigation allows for better information and electronic screens with actual times and departure hours changing in real time are becoming possible. This could reduce problem of search for interconnection which is often encountered in long-short distance combinations.

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