Electronic ticket as a key element for integration of regional and local public transport: examples of European solutions

Introduction

Systems of ticket sales for public transport services that have been functioning for dozens of years, and based on paper tickets are gradually becoming a barrier in the era of dynamic development of ICT technologies, barrier for the ticket-tariff integration and more efficient management of transport services offer. Thus, worldwide and in Europe, systems of electronic tickets (e-tickets) have been developing dynamically, and they ever more often become the basis for constructing integrated systems of local and regional passenger transport. The aim of the paper is to present the increasing role of e-ticketing technology in the ticket sale systems for public transport, as well as analysis of the systems implemented in European countries, from the point of view of their application in the process of passenger transport integration.

E-ticketing technology and its role in the process of integrating public transport

Fares for using public transport are paid worldwide by buying paper tickets, or – ever more frequently – the purchase of tickets which are in electronic form. Ticket distribution systems based on paper tickets, despite their advantages, also have numerous limitations. They are, first of all, limitations concerning the possibility of differentiating prices, as each time the extension of the range of tickets available for passengers, being more suited to passengers’ needs, requires printing additional types of tickets and paying the costs related to their distribution. Ticket distribution systems based on paper ticket do not allow collecting and analysis of data on demand for services. The organizer of public transport does not have the knowledge as to which ticket the passenger purchased and for which trip s/he used it. This, in turn, makes it impossible to adjust the transport offer to the needs of society, and to optimize it, from the point of view of costs of services provided. Paper tickets significantly limit the possibilities of transport integration. The data concerning the structure of paper tickets sold, coupled with data concerning the number of passengers transported on specific lines, obtained via costly vehicle occupancy studies, are often not sufficient for creating an accurate settlement system between partners of public transport integration projects/undertaking, e.g. member municipalities in municipal transport unions. The necessity of developing an accurate income settlement system, e.g. for common tickets, is often a substantial barrier for tariff-ticket integration [21, s. 50]. Thus, the e-ticketing technology is ever more widely used world-wide, as more efficient fare management is expected from it, first of all, as well as and connected with it, the possibilities of integrating fares charge by different transport organizers, and different transport modes within one tool, which will be friendly and easy to operate for the passenger. There are three main types of electronic tickets in use worldwide [8; 10, s. 377-377]:

- tickets and cards with magnetic stripe
- tickets sold via mobile phones
- contactless electronic cards.

The first electronic tickets emerged in London, in 1964 with the development of technology of cards with magnetic stripe [20]. It is a relatively simple and cheap technology, yet at present it is considered obsolete and is coming out of use. Cards with a magnetic stripe require physical validation in a validating

---

1 Dr A. Urbanek, Lecturer, Department of Transport, Faculty of Economics, University of Economics in Katowice, 1 Maja 47 Street 40-228 Katowice, office:+48 32 257 73 30, anna.urbanek@ue.katowice.pl
2 Reviewed paper.
machine, may be easily forged and copied, do not allow to collect data on demand, and have very limited functionality regarding price differentiation [1, s. 4-6].

A dynamically developing technology is the sale of tickets via mobile phones, smartphones, or tablets. Such a ticket may be purchased from any location. The role of mobile phones and the Internet in everyday life keeps on growing, it is also forecasted that their application of electronic fare collection for the use of public transport will continue to increase. One can distinguish three main possibilities of purchasing electronic tickets via mobile phone networks [8]:

- premium SMS: in this case the user pays the fare with the next phone bill, or using the funds available on her/his pre-paid, and receives a text message (sms) confirming the purchase of ticket
- in the technology of optical character recognition (OCR): in this case the user obtains a special code, e.g. bar code, or QR code, which contains all the necessary information concerning the trip, the passenger pays the fare using the pre-paid or by means of an application which connects to the bank account of the registered user
- by means of the Near Field Communication (NFC) data exchange technology: the process is much similar to the OCR technology, yet in the case of NFC the information is stored in the NFC memory of the device, e.g. smartphone.

The number of people who use wireless Internet in mobile devices, such as smartphones or tablets is continuously on the increase. Table 1 shows the share (in %) of people in the age range of 16-74 years of age, using wireless Internet on mobile devices outside home and workplace. In 2014, this share in the 28 EU member states increased by more than 41%, in comparison with 2012. At the same time, the increase noted in Poland amounted to nearly 64%. It is also worth noticing that in highly developed countries, such as Denmark, Finland, Sweden, the UK, or Norway, the percentage of users of wireless Internet in mobile devices amounted to 70% in 70%.

In case of contactless electronic cards, passengers use plastic cards with a built-in chip, storing the most important information. This kind of cards requires only to bring the card to the distance of some 10 cm to the reader, with which it connects by means of high frequency waves. The first electronic cards became widely used in the 1980s. Nowadays, they are in common use in the banking sector, healthcare, or in trade, where they are frequently a tool used in various loyalty programmes [14, s. 557-568]. The microprocessors used at present in electronic cards are produced on the basis of standards of the EMV technology (acronym of the names Europay, MasterCard and Visa). The EMV technology creates big opportunities concerning information processing and transaction management, which is of huge importance in case of collecting fees in public transport [8].

The electronic ticket technology creates vast opportunities of integrating payments for services provided by various transport providers and organizers of public transport. The modern technologies of e-ticketing enable dynamic settlement of costs and journey time, which require identification of entering the vehicle and leaving it. Various methods of identification for getting on and off the vehicle are used, yet the most common and advantageous for the public transport organizer is the Check-in/Check-out technology (referred to in foreign literature also as CICO, Tap-In/Tap-Out, or Touch-In/Touch-Out). It requires physical registration of the passenger, upon entering and leaving the vehicle, by placing a contactless electronic card or mobile phone in front of the reading device, located by the door. The system then calculates the fare due and charges the passenger’s account with it [7]. The passenger is often motivated to register when leaving the vehicle, because when s/he enters the fare is collected for the entire route, and part of the fare is refunded if the passenger travelled a shorter distance/section. This provides the public transport organizer with additional possibilities, e.g. introducing special bonuses or point systems, which will encourage the use of the Check in – Check out system. The application of Check in – Check out is vital from the perspective of managing the offer of public urban transport: identification of route sections on which vehicles are heavily occupied, as well as those where the level of occupancy is low, identification of income generated on specific lines, sections of those lines, attaching them to specific municipalities; as well as the integrated ticket environment, settlements between various organizers, service providers, and other entities functioning in public transport systems [21, s. 53-54].
Tab. 1. Share (in %) of people in the age range of 16-74 years of age, using wireless Internet on mobile devices in selected European countries, in the years 2012 and 2014

<table>
<thead>
<tr>
<th>Country \ Year</th>
<th>2012</th>
<th>2014</th>
<th>2012=100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU 28</td>
<td>36</td>
<td>51</td>
<td>141,7%</td>
</tr>
<tr>
<td>EU 15</td>
<td>45</td>
<td>59</td>
<td>130,6%</td>
</tr>
<tr>
<td>Austria</td>
<td>45</td>
<td>57</td>
<td>126,7%</td>
</tr>
<tr>
<td>Belgium</td>
<td>44</td>
<td>59</td>
<td>134,1%</td>
</tr>
<tr>
<td>Denmark</td>
<td>61</td>
<td>75</td>
<td>123,0%</td>
</tr>
<tr>
<td>Finland</td>
<td>56</td>
<td>69</td>
<td>123,2%</td>
</tr>
<tr>
<td>France</td>
<td>43</td>
<td>58</td>
<td>134,9%</td>
</tr>
<tr>
<td>Greece</td>
<td>23</td>
<td>37</td>
<td>160,9%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>55</td>
<td>70</td>
<td>127,3%</td>
</tr>
<tr>
<td>Spain</td>
<td>38</td>
<td>62</td>
<td>163,2%</td>
</tr>
<tr>
<td>Ireland</td>
<td>51</td>
<td>65</td>
<td>127,5%</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>63</td>
<td>70</td>
<td>111,1%</td>
</tr>
<tr>
<td>Germany</td>
<td>31</td>
<td>56</td>
<td>180,6%</td>
</tr>
<tr>
<td>Portugal</td>
<td>21</td>
<td>37</td>
<td>176,2%</td>
</tr>
<tr>
<td>Sweden</td>
<td>70</td>
<td>76</td>
<td>108,6%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>63</td>
<td>73</td>
<td>115,9%</td>
</tr>
<tr>
<td>Italy</td>
<td>16</td>
<td>24</td>
<td>150,0%</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>13</td>
<td>27</td>
<td>207,7%</td>
</tr>
<tr>
<td>Croatia</td>
<td>38</td>
<td>41</td>
<td>107,9%</td>
</tr>
<tr>
<td>Cyprus</td>
<td>25</td>
<td>43</td>
<td>172,0%</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>b.d.</td>
<td>37</td>
<td>b.d.</td>
</tr>
<tr>
<td>Estonia</td>
<td>37</td>
<td>58</td>
<td>156,8%</td>
</tr>
<tr>
<td>Iceland</td>
<td>60</td>
<td>68</td>
<td>113,3%</td>
</tr>
<tr>
<td>Lithuania</td>
<td>17</td>
<td>32</td>
<td>188,2%</td>
</tr>
<tr>
<td>Latvia</td>
<td>25</td>
<td>35</td>
<td>140,0%</td>
</tr>
<tr>
<td>Malta</td>
<td>40</td>
<td>51</td>
<td>127,5%</td>
</tr>
<tr>
<td>Norway</td>
<td>75</td>
<td>79</td>
<td>105,3%</td>
</tr>
<tr>
<td>Poland</td>
<td>22</td>
<td>36</td>
<td>163,6%</td>
</tr>
<tr>
<td>Romania</td>
<td>7</td>
<td>25</td>
<td>357,1%</td>
</tr>
<tr>
<td>Slovakia</td>
<td>38</td>
<td>50</td>
<td>131,6%</td>
</tr>
<tr>
<td>Slovenia</td>
<td>30</td>
<td>42</td>
<td>140,0%</td>
</tr>
<tr>
<td>Hungary</td>
<td>18</td>
<td>44</td>
<td>244,4%</td>
</tr>
</tbody>
</table>


Electronic tickets are used ever more commonly worldwide, as a tool for interconnection of local and regional public transport. Interconnectivity is a notion used often indeed in the European Commission documents, in relation to passenger transport integration. Its distinctive feature is the fact that it attaches
particular attention to technical aspects of the transport integration process. In line with the definition of the European Commission, of 1998 interconnection refers to horizontal integration of transport modes, in order to obtain integrated transport services "door to door", while a [pre]condition for such coordination is the transfer of specific technologies, devices, and equipment, advanced supervision systems and guidelines, as well as properly educated and trained personnel [9, s. 472]. Interconnectivity can thus be referred to if two transport system of the same mode or of different modes of transport and physically and operationally capable to co-operate to provide transport services unaffected by the borders of those systems [12, s. 94]. Interconnectivity is very frequently referred to in the context of passenger-friendly technologies, thanks to which it is easy to purchase a ticket or plan the journey using different modes of transport.

Integration of public transport is one of the main elements of joint transport policy of the European Union. That issue has been many times the leading topic of White and Green Papers published European Commission. As early as in 1992, in the White paper entitled The Future Development of the Common Transport Policy: A Global Approach to the Construction of a Community Framework for Sustainable Mobility, integration of transport was indicated as the main factor that will contribute to the increased popularity of public transport in Europe [17]. The focal area of the White Book of 2011: Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system is the mobility of EU citizens, which is particularly important for the development of internal market and life quality, as well as – which is connected with it – integration of networks, enabling passengers the better selection of transport means. Transfer hubs and points for various means of transport (airports, railway stations, bus stations etc.) should become “platforms of multimodal connections for passengers”. A particular stress has also been put on the fact that a multimodal journey should be facilitated by systems of information provided via Internet, electronic reservation systems and payment systems for transport services [23].

Opinion polls, conducted on a regular basis within the framework of Eurobarometer, commissioned by the European Commission Directorate-General for Mobility and Transport (DG MOVE) in EU member states indicate the need for developing solutions concerning integration in the transport sector. The questionnaire studies conducted in October 2010 as Future of Transport among the inhabitants of 27 EU member states (25 570 respondents took part in the research) indicates that single common ticket valid in all means of transport would encourage as many as 71% of the respondents to use public transport more frequently [6, s. 22]. Figure 1 presents the structure of responses (w %), broken down into EU member states.

One should point out that the development of new ways by which tickets can be purchased (e.g. via Internet, mobile phone) is one of the main effects expected in reference to competition on the market of rail transport services in the European Union. In the study conducted by Eurobarometer in 2012, concerning competitiveness of railway in Europe, entitled Rail competition, that was indicated by as many as 65% of the respondents (25 591 respondents from 25 EU member states participated in the study, excluding the inhabitants of Cyprus and Malta, where no railway network is in operation) [15, s. 8-9].

Undertaking integration activities, including the development of new, more convenient ways of purchasing tickets are important factors that contribute to increased attractiveness of public transport, in the opinion of European Union citizens. It is particularly valid in case of railway transport, the competitiveness of which keeps on decreasing, in relation to other modes of transport.
Fig. 1. Would the possibility of buying single ticket for all modes of transport encourage you to use public transport more frequently?
Source: Future of Transport, Analytical report, Flash Eurobarometer Series #312, The Gallup Organization, European Commission, s. 22

Examples of solutions in selected EU member states

Systems based on e-ticketing are ever more commonly implemented in European cities and regions. Public investments are often co-financed from the European Union budget. Studies conducted worldwide indicate that it frequently is the case that various e-ticketing technologies are used in parallel, in one region, or one city/town. What is more, e-ticketing Technologies have been functioning in one area, in parallel to the ticket distribution system based on paper tickets [11].

One of the most interesting solutions in e-ticketing, which integrates services of local and regional public transport is the example of Oyster card, implemented by the organizer of public transport in the Greater London are, namely the local government body named Transport for London (TfL). Oyster is a contactless electronic card, which is a carrier of season tickets/passes and enables paying fares for single journeys, in the Pay as you go system (based on the Check-In/Check-Out system), that is dynamic settlement of journey costs, based on registration of boarding the vehicle and leaving it. The Oyster card may be used in the Greater London area on lines where transport is organized by TfL and on a portion of railway lines operated by National Rail. An Oyster card may be topped up, or a suitable season pass may be saved on it via Internet portal, in passenger service points, ticket offices at stations and stops, as well as ticket vending machines (TVMs). What is of interest is the fact the entire Pay as you go system also includes contactless bank payment cards, thus the passenger does not have to hold an Oyster card, in order to make cashless payments for single fares. A big advantage of the system is also the fact that a passenger who uses public transport a few times in a given day will never pay more for all the tickets (fares) than s/he would pay for a one day (24 h) ticket. The following are included in the Pay as You Go system for Oyster cards [19]:
- London Underground
- DLR (Docklands Light Railway) – light railway, controlled automatically
- London Overground – city rail system
- as well 7 lines of National Rail (Chiltern Railways, First Capital Connect, Greater Anglia, C2C, Southern, London Midland, First Great Western) are in the Pay as You Go system of the London Oyster card.

National Rail is a trademark of the network of passenger railway transport companies (mainly private ones), which is used for the activities of providers associated in ATOC (Association of Train Companies). Those companies jointly perform the sale of tickets, provide passenger information, and take action to co-ordinate time tables [13].

What is more, the passenger may also purchase paper tickets: single ones, day tickets, season passes, etc. The ticket machines of TfL provide the possibility of purchasing paper tickets for National Rail included in the Greater London public transport system, also in a substantial portion of National Rail ticket machines one can purchase paper tickets for other means of transport, for which TfL is the organizer [19].

In the Greater London area, on the lines where the organizer is TfL a zone tariff is valid (9 zones), while prices differ depending on the means of transport used by the passenger. On the regional lines operated by the railway service providers of National Rail outside London, a distance-related tariff is valid, whereas in the Greater London area the tariff has been unified with the TfL system, where a zone tariff is valid (London is divided into 9 zones). Passengers may purchase tickets for regional rail transport in the framework of National Rail [13]:
- via the portal of National Rail (to be collected in a ticket machine, or delivered free of charge to the address of residence, tickets purchased via the Internet portal are, in many cases, cheaper than those purchased any other way)
- in ticket vending machines located at railway stations and urban transport stops in London area,
- in ticket offices at railway stations
- on the train from a conductor
- by phone (it is possible to collect the ticket in TVM or have it delivered to the place of residence).

Most of the British regional rail service providers have also launched the implementation of e-ticket system, where tickets would be available on contactless electronic cards, so that it is possible to pay for services in a system similar to the London’s Pay as You Go. Electronic cards are also, in such systems, the basic carrier of season passes. For example, the company Southern has been presently developing The Key Smartcard, which is a carrier of season passes, at present tests are going on for dynamic settlement of journey costs, keyGo, which is similar to the London’s system of Pay as You Go [16].

E-ticketing technologies, which integrate local and regional public transport are implemented also in Germany. An example may be the region of Berlin and Brandenburg, where the organizer of public transport is VBB Verkehrsverbund Berlin-Brandenburg GmbH, with seat in Berlin. VBB is the organizer of both urban transport services provided by means of urban buses, trams, underground (U-Bahn) and ferries in Berlin and other towns in Brandenburg, yet it is also the organizer of services provided by means of S-bahn urban rail (15 lines), and regional railway transport services via Regionalbahn in the entire province (Land) (43 lines, main service providers: DB Regio AG and ODEG Ostdeutsche Eisenbahn GmbH).

In the entire area of VBB activities there is one tariff for all service providers and means of transport. In towns and cities, in which the organizer of public transport is VBB, zone-based tariff is valid, as well as zone and time based tariff in case of single tickets. The S-bahn urban rail and regional rail (Regionalbahn) is fully integrated in the system and functions in zone-based and zone-time based tariff. In case of rural areas, the prices of single and monthly tickets depend on the distance travelled. Tariff based on distance is valid, and tickets are sold for specific routes. In the Berlin and Brandenburg region a passenger may purchase tickets for local and regional public transport in the following way [22]:
- on the train from conductors (a very limited ticket offer)
- at sales points
- at passenger services points
- in ticket vending machines (TVM) located mainly on railway stations and public transport stops
via mobile phone, smartphone, tablet, or PC, via the VBB-App „Bus & Bahn” integrated with the HandyTicket Deutschland system (working also in 20 other regions of Germany) – the passenger needs to top up her/his prepaid account, which is debited with fares; the ticket is a text message (sms) or has the form of QR code

- passengers registered in the Touch&Travel system, who have mobile phones of other devices enabling location detection, and functioning on the basis of wireless data exchange technology NFC (Near Field Communication) have the possibility of dynamic settlement of the costs of their journeys, based by the Check in - Check out system. It means that upon boarding a train or other public transport vehicle they scan a special code and make the so-called Check in, while upon leaving the vehicle they scan the code again, thus performing the Check out. The IT system automatically charges the fare due, in accordance with the tariff, which is displayed on the screen of the device. Moreover, the sum of single fares in a given day shall not exceed the price of a day ticket [18]

- in Berlin (within the three zones A,B,C) tickets can also be purchased via the portal of the Berlin transport company BVG (Berliner Verkehrsbetriebe) [2].

What is more, Since January 1, 2013 all monthly and yearly passes can be downloaded to the contactless electronic card, the so-called VBB-fahrCard. The functionality of that card has been continually extended. The card can be used in all means of public transport organized by VBB, including regional and local trains [22].

Also, in Germany there is also the so-called mobility card BahnCard100, which allows to connect the use of high speed trains with other long-distance transport services, as well as services at regional and local range. For the fixed monthly or yearly fee, the holder of BahnCard100 may Ravel without limitations in Germany [4]:

- by high speed trains ICE, TGV, and Railjet (between German stations)
- by high speed trains Thalys International, only between Koeln and Aachen (only in car No. 28 and dining car)
- by all other long distance trains, where the transport organizer is DB Bahn, including also EuroCity and EuroNight
- by regional DB Bahn trains
- by selected railway of local type, the organizers of which are specific regions (Land) or towns, e.g. S-Bahn, City-Bahn in Chemnitz (some 65 service providers in total)
- by means of public urban transport, the so-called City-Ticket (for buses, trams, and underground), between the railway station and the destination/start of journey, in 133 towns in Germany.

The offer of DB Bahn also includes two other types of the same card: BahnCard25 and BahnCard50. The range of their offer is pretty similar to that of BahnCard100. The numbers: 25 and 50 in the card name stand for the percentage of discount on standard price of a ticket, to which the card holder is entitled. Thus, BahnCard100 allows to use all services free of charge, while BahnCard25 enables purchasing tickets with a 25% discount. It should be noted that BahnCard25 and 50 are not recognized by Thalys International [4].

After signing an additional agreement with the bank that issues the card, BahnCard may become a credit card at the same time, as well as a tool which gives the passenger the opportunity to participate in the loyalty programme of DB Bahn [4].

Another European country, in which electronic ticket technologies are implemented is the Czech Republic. A vast majority of regions in that country have been developing agreements concerning integrated transport systems, within which e-ticketing is implemented. An example may be the local and regional public transport in the region of Hradec Královo and Pardubice, which is integrated in one system called IREDO (Integrovaná regionální doprava Královéhradecké a Pardubického kraje), in which the zone-based tariff is valid. In the region of Hradec Královo and Pardubice the season passes/tickets, since September 1, 2013 have been coded on IRED electronic cards. Since the beginning of 2014 they have stopped selling season tickets in paper form. The IRED card is also a carrier of electronic Money (electronic purse), which may be used for purchasing single tickets. Regional railway transport services are provided by the national rail company České dráhy a.s. Tickets for regional railway transport services provided by České dráhy can be purchased [3]:

- by high speed trains ICE, TGV, and Railjet (between German stations)
- by high speed trains Thalys International, only between Koeln and Aachen (only in car No. 28 and dining car)
- by regional DB Bahn trains
- by selected railway of local type, the organizers of which are specific regions (Land) or towns, e.g. S-Bahn, City-Bahn in Chemnitz (some 65 service providers in total)
- by means of public urban transport, the so-called City-Ticket (for buses, trams, and underground), between the railway station and the destination/start of journey, in 133 towns in Germany.

The offer of DB Bahn also includes two other types of the same card: BahnCard25 and BahnCard50. The range of their offer is pretty similar to that of BahnCard100. The numbers: 25 and 50 in the card name stand for the percentage of discount on standard price of a ticket, to which the card holder is entitled. Thus, BahnCard100 allows to use all services free of charge, while BahnCard25 enables purchasing tickets with a 25% discount. It should be noted that BahnCard25 and 50 are not recognized by Thalys International [4].

After signing an additional agreement with the bank that issues the card, BahnCard may become a credit card at the same time, as well as a tool which gives the passenger the opportunity to participate in the loyalty programme of DB Bahn [4].

Another European country, in which electronic ticket technologies are implemented is the Czech Republic. A vast majority of regions in that country have been developing agreements concerning integrated transport systems, within which e-ticketing is implemented. An example may be the local and regional public transport in the region of Hradec Královo and Pardubice, which is integrated in one system called IREDO (Integrovaná regionální doprava Královéhradecké a Pardubického kraje), in which the zone-based tariff is valid. In the region of Hradec Královo and Pardubice the season passes/tickets, since September 1, 2013 have been coded on IRED electronic cards. Since the beginning of 2014 they have stopped selling season tickets in paper form. The IRED card is also a carrier of electronic Money (electronic purse), which may be used for purchasing single tickets. Regional railway transport services are provided by the national rail company České dráhy a.s. Tickets for regional railway transport services provided by České dráhy can be purchased [3]:

- by high speed trains ICE, TGV, and Railjet (between German stations)
- by high speed trains Thalys International, only between Koeln and Aachen (only in car No. 28 and dining car)
- by regional DB Bahn trains
- by selected railway of local type, the organizers of which are specific regions (Land) or towns, e.g. S-Bahn, City-Bahn in Chemnitz (some 65 service providers in total)
- by means of public urban transport, the so-called City-Ticket (for buses, trams, and underground), between the railway station and the destination/start of journey, in 133 towns in Germany.
– in sales points
– in ticket vending machines located in bigger railway stations
– via Internet, in ČD eShop – the ticket will be e-mailed in electronic form to the passenger e-mail, it may be printed or displayed in mobile phone, tablet, or PC. Both season and single tickets may be purchased in the Internet shop
– also the InKarta may be the carrier of tickets purchased in the Internet shop. The holder of InKarta, issued by České dráhy, is entitled to get additional discounts in the whole territory of the country. InKarta is also a carrier of electronic money (e-purse), thanks to which the passenger may purchase tickets in ticket machines or sales points, among others
– from the conductor, on the train, it is also possible to pay for the ticket using the InKarta as e-purse
– using a smartphone for purchasing in ČD eShop – then the ticket has the form of QR code.

Conclusions

The systems of ticket sales, which use modern information and Communications Technologies (ICT) seem to be the key for construction of a system of local and regional passenger transport. They enable passengers to use the offer of various service providers in one place, simplify access to information, planning of intermodal journeys, as well as purchase of tickets. What is more, they make it easier to manager transport service offer and its optimization, through better identification of journeys made, as well as – which is particularly valid in case of tariff-ticket integration – they enable identification of parameters, which are the basis of mutual settlement between entities.

Particularly dynamic in their development are the systems based on intelligent contactless cards, which may carry season passes of different public transport organizers, even those who do not co-operate in terms of tariffs. Dynamic development also takes place in the realm of purchase and payment technologies, where mobile phones are used for paying public transport fares. Within one region, different e-ticketing technologies function in parallel to one another, and alongside the paper tickets distribution systems. Still, the many functionalities of electronic tickets, and convenient purchasing of them, will probably be the factors which in future will bring marginalization of paper tickets.

Abstract

IT systems, implemented ever more widely in all branches of the economy, also increasingly become tools for integration of various stages of transport process, transport modes, and transport offer of different entities functioning on the market. E-ticketing technologies are increasingly used as tools for integrating public transport worldwide. The paper discusses the role – gaining in importance - that electronic tickets play in sale systems that distribute tickets for regional and local passenger transport. Using the example of solutions implemented in selected regions of the UK, Germany, and the Czech Republic, an analysis has been made, concerning the application of those technologies in the public transport integration process.

Bilet elektroniczny jako kluczowy element integracji regionalnego i lokalnego transportu zbiorowego: przykłady rozwiązań europejskich

Streszczenie

Systemy informatyczne coraz powszechnie wdrażane we wszystkich gałęziach gospodarki, coraz częściej również stają się narzędziem scalającym poszczególne etapy procesu transportowego, gałęzie transportu oraz ofertę przewozową różnych podmiotów działających na rynku. Coraz częściej wykorzystywany narem narzędzi integracji publicznego transportu zbiorowego na świecie stają się technologie biletu elektronicznego. W artykule omówiono rosnącą rolę biletów elektronicznych w systemach sprzedaży biletów regionalnych i lokalnych przewozów pasażerskich. Na przykładzie rozwiązań wdrożonych w wybranych regionach Wielkiej Brytanii, Niemiec i Republiki Czeskiej dokonano analizy zastosowania tych technologii w procesie integracji publicznego transportu zbiorowego.
BIBLIOGRAPHY


[18]. Touch&Travel Deutschland, www.touchandtravel.de (date of access 20.04.2015).


