

ASSESSMENT OF THE IMPLEMENTATION OF THE ELECTRONIC CITY CARD SYSTEM IN BIAŁYSTOK

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The objective of the paper is to assess the implementation of the electronic city card system in the city of Białystok. The city card has been used since July 2011 in Białystok. This is a system which covers fewer functions than a similar system in Wrocław. A comparison of the city card with paper tickets with respect to the functions they cover is favourable for the new solution. A questionnaire study performed in 2014 among passengers resulted in a positive assessment of the new solution of the electronic city card system.

Keywords: electronic city card system, city logistics, IT solution

1. Introduction

Large cities are characterised by fast development in the areas of economy, production, culture and fast development of transportation networks [8]. Effective functioning of cities is possible as a result of managing transportation. Transport which includes the carriage of goods, persons and information by applying appropriate means is a core factor determining economic development of cities [1].

City logistics is applied to resolve problems related to the growing traffic in highly urbanised agglomerations [4]. The idea to apply logistics for those purposes was first applied in the late 1990s resulting in the establishment of a new field of knowledge [15]. City logistics has a macroeconomic dimension and nevertheless it is focused on specific areas functioning in specific micro regions [7]. The essence

of city logistics is provided e.g. in the definition developed by the Council of Logistics Management (CLM). "City logistics is termed as a process of planning, performing and controlling of flows initiated outside and directed towards the city, initiated in the city and directed to the outside, passing through the city and internal in the city, and the accompanying flows of information, aimed at providing for the needs of city agglomerations in the area of management quality, life quality and development" [14]. "City logistics is also defined as a process optimising all activities related to the storage and transport performed by enterprises in the city with due focus on the surrounding of the processes, transport congestion and energy consumption in a market economy" [5]. According to B. Rzeczyński "city logistics provides assumptions to optimise the city system with respect to planning, controlling and supervising all conditions that are subject to traffic, the occurring processes in the economic, ecological, technological and social dimensions" [6]. Another definitions developed by German authors terms city logistics as a "set of actions based on collaboration among forwarders, carriers and other entities in logistics centres as well as those outside centres, aimed at coordinating provisions to the city subject to combining goods flows in order to minimise the number of operations and goods traffic in the city" [2]. City logistics consists in controlling the flows of all resources within the city between sub-systems [3].

Activities covered by city logistics may be carried out by city authorities as well as municipal companies such as public transport, utilities (gas, heat and water suppliers, city sewage treatment plants [16]. City transport and the related passenger flows are a specific area of city logistics [14]. Public transport consists in moving people (less frequently goods) solely within city limits or in the suburbs. Public transport is performed at specified time intervals along designated transportation routes and is generally accessible to inhabitants [18]. The application of modern technologies facilitating the use of public transport is a good solution resulting in acquiring a larger number of passengers for public transport. Those include multifunctional city cards [9].

The Electronic City Card System in Białystok uses microprocessor media that constitute a part of an intelligent system. A plastic card similar to a bank card is used. The required data is stored in the card memory. Cards are issued at designated outlets where they can be personalised and recharged. The name of the city card is often abused and identified with electronic tickets – however, it may have at least one more function than a standard e-ticket. City cards may additionally be used for parking or entry to various cultural and sports facilities [10].

The functions of the Electronic City Card System include: possibility to operate loyalty programs, fast and seamless modifications to the prices, electronic sales of tickets, one method to charge services for several city services, monitoring of service quality, easy method to charge fees for riding without tickets, an

improved image of city services, possibility to generate analyses as required by customers, reduced costs of city services [11].

2. Methods of research

The objective of the paper is to present a modern method of information management in public transport - being the electronic city card system. The city of Białystok was selected for the study where such system was implemented in 2011. The study is based on questionnaires addressed at passengers and interviews with employees of the Municipal Public Transport Enterprises in Białystok. The questionnaires and interviews were held in the first quarter of 2014. The results of the research are presented in several stages. In the first stage, a comparison was made between the city card system applied in Białystok and the one implemented in Wrocław. Subsequently, a comparison was made between the functions of city cards and paper tickets. The questionnaires resulted in an assessment of city cards by passengers.

3. Results

The electronic city card system in Białystok is a comprehensive IT solution covering passenger transport and payments for services provided by public transport operated by the City of Białystok. The system comprises a central system named the System Support Centre (COS), located in the City Office of Białystok and the interoperating site sub-systems that include: vehicle systems on board, electronic cards containing public transport tickets, card sales and personalisation outlets [12]. All those elements made up one integrated IT system supporting the Białystok City Card. The central system is composed of several modules responsible for various functions, e.g.: system administrator tasks, sales and overall customer service, card personalisation, data transmission, data processing and standardisation, analyses and report generation, monitoring of vehicle and data transmission to information boards at stops, analyses of contracts and operators' settlements, support to the system responsible for calculation of passenger flows in public buses.

The implementation of the electronic city card system in Białystok was preceded with a number of preparations. The first element was to implement an electronic system to measure punctuality in 1991. The next stage was to implement a modern passenger counting system in 2001 in 58 buses. Since 15 November 2010 it has been possible to pay with mobile phones for tickets [13]. The construction of an integrated electronic city card system began late in 2010 and the system was implemented in July 2011. On 14 July 2011 a full ticket offer was made available

on the basis of the electronic city card system. First, the new system was being tested with the old system of season paper tickets operating in parallel.

Apart from Białystok, also the city of Wrocław decided to implement electronic city cards. In order to identify the sophistication level and the features of the systems, it is necessary to compare the systems and to present the functions of city cards in Białystok and in Wrocław. The Wrocław city card has been functioning since May 2010 and it is based on UBRANCARD.

The major differences between systems used in Białystok and in Wrocław include the scope and the offered functions. The Wrocław card cover public tram and bus transport while the Białystok card covers solely buses. The operations of the cards, their functions, differences and similarities and plans for the future are presented in table 1.

Table 1. Functions of the city cards in Białystok and in Wrocław

Name of function	Białystok City Card	Wrocław City Card
Electronic public transport ticket with a possibility of counting passengers	When a season ticket is purchased, public buses can be used. On entry, the tickets shall be approached to the activation device.	When a season ticket is purchased, public buses and trams can be used. On entry, the tickets shall be approached to the activation device.
Electronic city purse	The function enabling transfer of a specific amount, enables the purchase of single-ride tickets.	No function – only electronic city single-ride tickets can be purchased.
Fees for parking	The function is planned when the functions of the city card are extended.	The function operates in combination with the city card and the park meter system.
Tickets to Aquapark and the Zoo	No function	It is possible to code the ticket to the card subject to prior personalisation.
Operation in libraries	No function	Possibility to use in selected Public City Libraries.
Entry tickets to mass events.	Entry to the city stadium.	No function
Payments with the city card.	The function is planned by PKO	Citibank City Debit Card, Visa prepaid Visa cards, payWave BZWBK
Tickets for passenger trains	No function	Possibility to ride passenger trains without additional fees in Wrocław.

Source: Author's study on the basis of information published on web sites

The Wrocław city card integrates many more sphere of life of the inhabitants that the Białystok city card. The URBANCARD may be used as a reference for future development for the Białystok city card.

Before implementing the city card, a system functioned in Białystok that was based on paper season tickets. Such tickets contained the holder's photo, their exact details and information on any reductions holders may have. The person verifying ticket validity also had to verify a separate document entitling to reductions. Such

season paper tickets were extended by the purchase of a special stamp at a customer service outlet with a validity date to use public transport in the specified zones and times. The ticket was comfortable to use since its usage within its validity was limited solely to displaying it controllers; no validation on buses was required. However, the system was open to abuse, did not provide sufficient information required to enhance public transport and adversely affected the image of public transport in Białystok. In order to assess the validity of the decision to implement the new system it is necessary to compare the season paper ticket system with the electronic city card system. Table 2 contains a specification of functions and operations performed by both systems. The first column presents a specific function or operation while the other two columns provide information on the relationship of each operation with the relevant system. In each line the word “yes” means that the specific function or operation is related to the relevant system while the word “no” means that it does not exist.

More negative features were displayed by the season paper ticket system: as many as 19 out of 28 of all the operations and functions in the table. The electronic city card system had as few as 6 negative factors out of the 28 functions. Thus, the new system had more positive features than the previous one.

Table 2. Functions of the electronic city card system and the periodic paper ticket system

Function/operation	City card	Paper tickets
Alignment of customers' data with the sold services, possibility to determine the overall demand for a specific service	yes	yes
Recharging the season ticket over the Internet	yes	no
Planning of future demand for the services for a specific public line in terms of time and location	yes	no
Identification of the number of passengers by age groups	yes	no
Modification of transport tariffs for age groups	yes	no
Acquisition of information on the places of ticket purchase at a specific time and identification of service outlets with excessive load	yes	yes
Counting of passengers in each bus	yes	no
Analysis of bus line load during the day	yes	no
Automatic identification of delays at stops	yes	no
Identification of the actual bus location	yes	no
Possibility to acquire various information on passengers	yes	no
Automatic generation of reports and analyses	yes	no
Support to services related to settlement of services between the various involved entities	yes	no
Ongoing supervision over the correct performance of services	yes	no
Automatic information on any system failure	yes	no
Possibility to account for all applicable reductions	yes	yes
Need to hold a document confirming the right to reductions	no	yes
Possibility to purchase single-ride tickets in vending machines on the bus for the passenger and accompanying persons	yes	no

Table 2. Continued

Function/operation	City card	Paper tickets
Possibility to purchase tickets from the driver	yes	yes
Possibility to recharge the ticket only for the specific month irrespective of the recharging day	yes	yes
Performance of more than one operation by the electronic ticket	yes	no
Automatic analysis of punctuality	yes	no
Need to place the ticket on the validation device	yes	no
Possibility to forge tickets	no	yes
Possibility to determine the passengers' route by the operator	yes	no
System failure rate	yes	no
Modification to the prices of services without costs	yes	no
Insufficient number of appropriate validation devices	yes	no

In order to obtain an opinion on the implementation of the city card system in Białystok it was necessary to carry out a questionnaire among 100 random users of public transport. The questionnaire contained 20 questions. The questionnaire was completed by three persons aged up to 18, 62 persons aged 19-29, 21 persons aged 30-40, 7 persons aged 41-51 and 7 persons above 51 years of age. Most of the persons completing the questionnaire identified commuting to school or work as the basic reason for travel (totally 65 persons) and the use public transport every day (57 respondents). Out of the 20 questions, six referred to the city card. The responses to question one showed that a majority - as many as 56 persons – assessed the reliability of the system as good while nine persons stated that the reliability was very good (Fig. 1) Poorly and very poorly the reliability was assessed by 15 and 6 persons respectively and 14 persons were not using the city card. The assessment of the access to service outlets in Białystok was assessed slightly worse. Responses to the question are presented in Fig. 2.

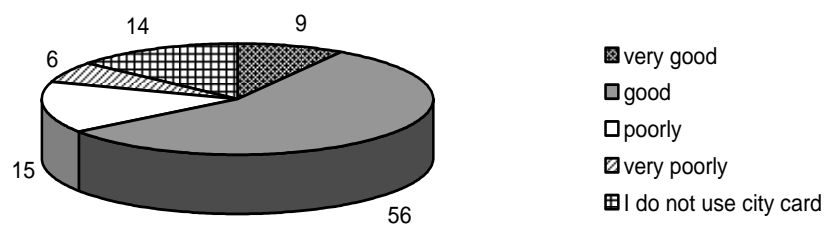


Figure 1. How do you assess the reliability of the city card system in Białystok?

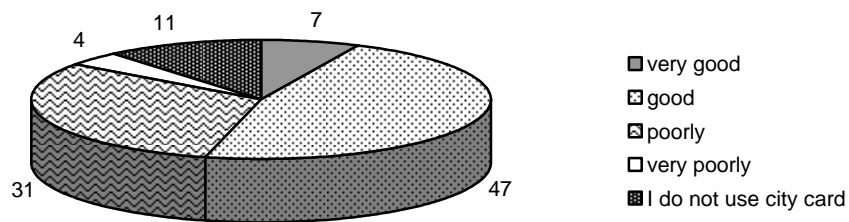


Figure 2. How do you assess the accessibility of customer outlets where the city cards can be recharged?

The largest number of users – as many as 47 responded that the access to customer outlets where the city cards can be recharged was good. 31 respondents stated that the access to such outlets was unsatisfactory. The accessibility of such outlets was defined as very poor by four respondents, as very good by seven with 11 persons answering the questionnaire did not use the city card.

The questionnaire was also aimed at identifying the knowledge of users of the city card functions; therefore, an open question was also asked: Do you know the functions of the city card? The responses are presented in Fig. 3.

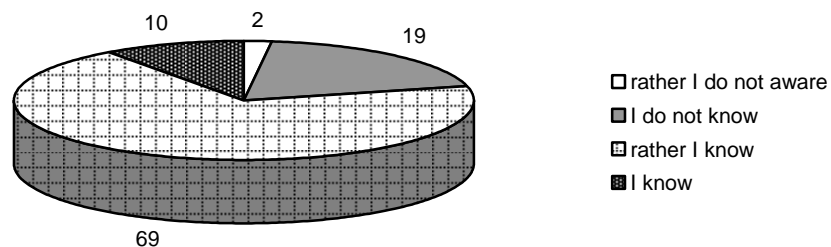


Figure 3. Do you know the functions of the city card?

A large majority of the respondents – as many as 69 thought they were aware of the functions of the city card, 19 had no idea of such functions and two persons stated that they were not aware of the functions. Only 10 persons listed all the functions of the cards.

The next question in the questionnaire was as follows: How do you assess the need to touch the card to the validating machine in a public bus? The results are presented in Fig. 4.

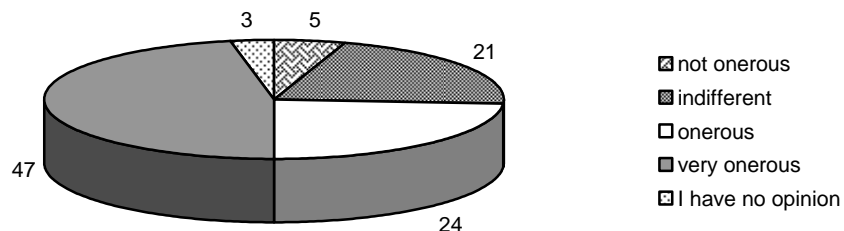


Figure 4. How do you assess the need to touch the card to the validating machine in a public bus?

Only five persons stated that the need to touch the card to the validating machine at entering a public bus was not onerous. A vast majority – as many as 47 persons found the operation as very onerous, 24 as onerous, 21 were indifferent and only three persons had no opinion.

The electronic purse as mentioned earlier is an additional function of the city card. The results of the questionnaire present that it is hardly used by users of public transport (Fig. 5).

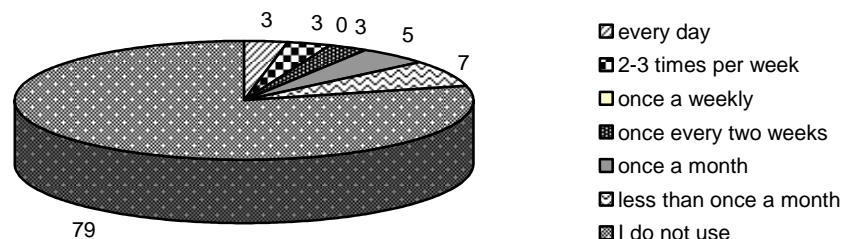


Figure 5. How often have you used the electronic purse function with the city card?

A vast majority – as many as 79 respondents did not use the electronic purse function and only as few as three persons used the function every day. A conclusion is that the function is not very useful for users.

In order to assess the validity of the decision to implement the city card among passengers, the following question was asked: Do you think that the implementation of the city card in Białystok was a right decision? The result is presented in Fig. 6.

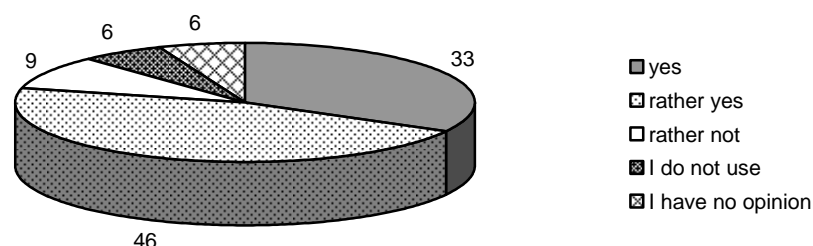


Figure 6. Do you think that the implementation of the city card in Białystok was a right decision?

The responses to the question show that the decision to implement the city card was found as correct by users as it was confirmed by 33 respondents and as a principally right decision by 46 respondents. The decision to implement the system was negatively assessed by six respondents and as a rather incorrect decision by nine persons while six users of public transport had no opinion. Thus, the implementation of the electronic city card in Białystok was positively assessed by users. The fact is further confirmed by another question – for a majority of people (53 respondents), the city card system was more favourable than the earlier system while 29 respondents selected the older system of season paper tickets as more favourable; 15 had no opinion and three persons did not remember the old system. The presented details provide the results to the question: which of the season ticket systems was more favourable for you?

4. Summary

The electronic city card system is a modern solution to improve the management of public transport in many cities, e.g. in Białystok and in Wrocław. The Białystok city card is a system with a lower assessment than the UBRANCARD used in Wrocław since it has less functions integrating various spheres of life of the inhabitants and the system is less advanced.

The proximity city card in Białystok provides access to season tickets containing all the available reductions, it provides for entry to the city stadium, has a possibility to cover functions for large families and the electronic purse function. The city card has many more functionalities than the previous season paper ticket system. The city card system provides for collection of data on passenger routes which ensures better planning of the occupancy of bus lines. However, the new system is more prone to generate errors than the previous one.

An analysis of the responses to the questionnaire by public transport passengers generates a conclusion that despite several deficiencies (e.g. the need to touch the city card to the validation machines at each entry to the bus, an insufficient number of recharging outlets), the inhabitants positively assess the implemented system. A majority of the inhabitants found the electronic city card system as a better solution than the previous season paper tickets.

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