Measure Evaluation Results Template

TAL 2.2 Public Transport Ticketing System

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Version:

MRT – F level

Date: January 2013

          Revised version April 2013

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Executive Summary

The measure 'Public Transport Ticketing System' was aimed at creating an innovative and secure contactless, online ticketing system for the users of the public transport (PT) network in Tallinn. The objectives were to increase the opportunities to purchase PT tickets, to facilitate the validation of the transport ticket and to introduce a number of combined-service and multi-journey tickets. An additional objective was to establish an automated collection of PT usage statistics to enable better PT capacity and route planning. The target groups of the measure were PT users and transport planners. While the new system made using PT less convenient for the users due to the new obligation to validate trips, users benefitted directly from the different transportation systems integration into the new ticketing system. Transport planners benefitted from the creation of a reliable database gathering significant information to support them in the daily planning and decision-making process towards a better PT management. Tallinn City implemented fare free PT for all city residents since 1.1.2013. The idea was introduced in January 2012 and had no connection to the CIVITAS MIMOSA measure "TAL 2.2 PT ticketing" that was initiated in June 2009. Fare free is just one ticket type for city residents.

The measure was implemented in the following stages:

Stage 1: Preparation (2009-2010) A starting phase, a study of the existing ticketing systems was carried out to identify possible suitable ticketing systems for Tallinn. A second phase consisted of the elaboration of the terms of reference of the public tender for the implementation of the ticketing system.

Stage 2: Procurement (2010-2011) The public tender was launched and followed the legal procedure defined by the Estonia code. The contract was signed between the Municipality of Tallinn and United Tickets Ltd in December 2011.

Stage 3: Installation of the system (2012) The software which manages the entire system was designed. A pilot project was conducted on selected buses on which the related equipment (on-board computers, validating machines, and printers) were installed and tested. The system was launched in September 2012.

Stage 4: Dissemination campaign (2012) To reach the broader general public and encourage PT users to test the new ticketing services, a communication strategy had been elaborated based on special bus campaigns and awareness campaigns, publication in newspapers, radio and television broadcasting.

The evaluation consisted on an impact and a process evaluation. Impacts of the measure were evaluated by tracking changes between the year 2011 and 2013-2016 (defined in the contract with United Tickets Ltd) in the annual costs of the PT ticketing system as well as in public awareness and acceptance of the system between November 2009 and September 2012. The data on costs was provided by the City Government. The level of awareness and acceptance were measured by conducting surveys, before and after the implementation of the measure.

The **key-results** of the evaluation highlighted the success of the measure: between 2010 and 2013-2016 running costs for Tallinn PT ticketing system were reduced by 64% and the level of citizens' awareness on the new PT ticketing system increased over four times. The level of acceptance for the implementation of the new ticketing system increased slowly by 18% between 2009 and 2012 among interviewed citizens. Since the survey was conducted prior to the launch of the ticketing system, it is

expected that the level of acceptance will increase in the following months, after the start of the system in September 2012.

Several **main barriers** were encountered during the implementation process: Due to appeals from different bidders a ten month delay occurred during the public procurement procedure. This caused delays in the implementation of the measure. As a result of the innovative aspect of the measure, the design and elaboration of the software and related devices for the new PT system, it took more time than had been anticipated. Another barrier was the difficulty to encourage PT users to shift from the existing ID-ticket system – still in use until the end of March 2013 – to the new digital ticketing system. Users considered the ID-ticket system convenient and did not notice direct benefits for them to change their habits towards a digitalised ticketing system.

Two **main drivers** should be mentioned. Firstly, the measure was part of the Sustainable Development Plan of the city and this guaranteed both political support and financial resources to develop and implement the measure. Secondly, the availability of advanced technology for the design and implementation of such an innovative system enabled successful achievement of the measure.

Some recommendations resulted from the experience in Tallinn. The cost of the card is low and the information registered on the card does not contain personal data which makes the contactless an appropriate solution for PT ticketing system. The system can be extended on a large scale and can contribute to supporting the creation of a PT network between cities. Regarding the planning process of the measure, it is recommended to foresee a realistic planning time schedule to prevent failures due to time pressure. Finally, it is highly recommended to keep politicians continuously informed on the progress of the project to ensure their support during the entire process.

The measure was a success in Tallinn and provided a strong basis for PT service improvements in the following years. Firstly, the PT users' data provided by the system is a significant advancement for any future users-oriented PT planning in Tallinn. Secondly, the extension of an integrated ticketing service is possible thanks to the flexibility of the system which has the potential to integrate additional services without technological limits. Furthermore, the possible future implementation of the ticketing system in other Estonian cities is an opportunity for the development of a common "supra-urban" ticketing system in Estonian cities and regions.

A   Introduction

A1   Objectives

The measure objectives are:

(A) High level / longer term:

- Increase of modal split towards sustainable modes.

(B) Strategic level:

- Create an innovative and secure contactless, online ticketing system for Public Transport (PT);

- Increase the passenger convenience providing a maximum number of channels possible for ticket purchase and use;

- Introduce a number of combined-service and multi-journey tickets;

- Implement the automated collection of PT usage statistics by transport type, route, time-of-day, day-of-week and other criteria to enable better PT capacity and route planning.

(C) Measure level:

(1) Create conditions for the use of re-usable ticket;

(2) Increase satisfaction of passengers;

(3) Demonstrate the collection and reporting of real-time statistics of PT usage by selected routes and time criteria;

(4) To address decision makers and stakeholders to demonstrate the advantages of an integrated ticketing system where an unlimited number of possible PT ticket pricing policies can be applied;

(5) To obtain experiences from other European cities which have implemented contactless PT ticketing systems. Using CIVITAS as a platform of exchange for creating a synergy will support the implementation of such innovative solutions;

(6) To carry out an information campaign addressed to passengers to replace the paper-based tickets with electronic contactless tickets and to inform about new ticket types;

(7) To draw conclusions, give recommendations and specify state and local level transport development plans that are now rather general in this respect.

(B) The expected outputs are:

(1) New innovative and user friendly PT ticketing system developed and deployed;

(C) The expected results are:

(1) PT users awareness and acceptance of new ticketing system increased by 20%

(2) Decreased costs for ticketing system maintenance by 15%

A2 Description

The measure was aimed at testing a new modern electronic online ticketing system for all types of public transport (PT) tickets and time-based cards. The system consists of contactless cards, ticket registering validating machines (validator) at all PT vehicle entrances (Figure 1), printing devices by driver for 1-hour paper tickets, control devices, central server of the system and modems for connecting central server with PT vehicles. The measure was about finding a modern and optimal solution for Tallinn, procurement of necessary equipment and implementation of the system.

Figure 1 Contactless card validator

The system is mainly aimed at gathering PT usage information for traffic planners and providing more flexible and interconnective system for passengers. The PT usage information is important for managing and optimisation of Tallinn PT network. Flexibility means possibility for different ticket types in one card and interconnectivity guarantees use of the same card in the city and regional PT, also other services. For some passengers the user comfort was lowered, because the previous ID-card based system did not require validating every trip in case of period cards. However, this comfortable system came in a cost of not having any origin-destination information on PT usage.

Tallinn City implemented fare free PT for all city residents since 1.1.2013. The idea was introduced in January 2012 and had no connection to the MIMOSA measure "TAL 2.2 PT ticketing" that was initiated in June 2009. Fare free is just one ticket type for city residents. While PT is now fare free for most of PT users, the usage information is still needed for managing and optimising the PT network.

Passengers have to register at the beginning of their trip using their personal contactless card when entering the PT vehicle. This gives transport planners information on trip origins and destinations (by registering the return trip of the same anonymous passenger ID), as well as the usage of particular lines. The information is the most important input for optimizing the PT network and individual PT lines. The benefit for the users of PT is a wider and more flexible fare system with more options for combining different public transport modes and services.

The validator is also capable of communicating with Near Field Communication (NFC) compatible devices (such as mobile phones) and this facility is under development to be implemented in the near future. This means that users do not need an additional contactless card but can register their trip with a NFC compatible mobile phone.

Some scholar and student contactless cards issued in the last few years are compatible with the new PT validating system. These cards can be used for validating on PT already from beginning of the implementation of the system.

As a first step of implementation of full scale ticketing system, there was a planned installation of 100 PT vehicles with devices, creating new software and testing the system during the MIMOSA project. After the results from the testing were found satisfactory to the needs of Tallinn city, all other 505 PT vehicles were equipped with the same devices.

As the result of the public procurement and the fact that 145 buses were equipped with the necessary onboard computers during the implementation of Measure 2.3 (PT Communication System), the number of PT vehicles equipped under the budget of this measure was increased. 171 buses instead of 100 were equipped with validating devices, including 574 validators and 40 control devices. Installation was carried out from June 2012 and creating the software was completed in August 2012. The new ticketing system was promoted in cooperation with the measure 4.1 "Mobility Management and marketing activities directed at popularizing usage of active transport modes" in September 2012. An information booklet from the promotion campaign material is presented on the Figure 2.

Figure 2 Information booklet about the new contactless e-ticketing system was designed in accordance with the Design Standard.

B   Measure implementation

B1   Innovative aspects

The innovative aspects of the measure are:

- **Use of new technology** - The contactless ticketing system enables full scale trip data collection based on user registration on entry to the vehicle. Data collection of this scale and detail has not been used in Tallinn before. The technology also enables dynamic fares to be used in PT.

- **New conceptual approach** – The system is not aimed at servicing PT users only but has the equal importance of gathering PT usage data for optimizing the PT network. The system has also the possibility to homogenize and prepare interconnectivity of the public transport ticketing systems of Tallinn and Harju County, also interconnectivity with contactless ticketing systems in Estonia or other countries.

B2   Research and Technology Development

A workshop was organised with moderator from CIVITAS VANGUARD for presenting examples from the City of Ljubljana and TransLink Systems in Holland. Participants were from City of Ljubljana (Slovenia), Emilia-Romagna region (Italy), different departments of Tallinn Municipality, Road administration and private companies as possible bidders in the procurement process.

Topics of the workshop concerned choice of contact free card based on various technical parameters, location of information (on card, in database or in vehicle), identification, integration of other uses of the card both from different functions and different regions, availability of statistical information from the system, cost, risks with procurement process. The topics were analyzed, discussed in groups of different stakeholders and results presented to all participants.

Two principally different systems were chosen for consideration as a result of the workshop. Ljubljana has a typical closed system with a high security level, Holland has "1 card 4 all" principle which gives virtually unlimited possibilities to use the card. It was started in Amsterdam and Rotterdam and now is in use in all regional trains of Holland. Tallinn preferred the open system as created in Holland for connecting step-by-step all other regions of Estonia to the same ticketing system.

B3   Situation before CIVITAS

Before the introduction of a contactless ticketing system users had 4 ticketing methods in Tallinn PT:

1. Legacy paper-based tickets, which could be used only for one ride; passengers used mechanical or electro-mechanical markers (composters) to mark the ticket for use. The mechanical marking consisted of combination of holes identifying the particular public transport vehicle by comparing the holes, or a time stamp made by electro-mechanical markers.

2. Paper-based tickets for 1, 3, 10, 30 and 90 (until July 2011) days. The paper based tickets were not personalized and were more expensive than the corresponding electronic tickets.

3. Hourly paper-based tickets which have to be marked with electro-mechanical markers, which print date, time and bus ID on the ticket. 1- and 2-hour tickets are available. This kind of ticket was introduced in full scale in 2005. The electro-mechanical system is not online and does not

record time or location of registering a ticket.

4. ID-tickets based on the Estonian Electronic Identity Card (ID-card) and mobile phones, introduced in 2004. ID-card based tickets are personal and can be bought through the internet and through mobile phones. Available ticket periods are 1 and 2 hours, 1, 3, 10, 30 and 90 days. Hourly tickets can be bought with mobile phone only. None of the ID tickets required any registering of trips.

The introduction of the ID-Ticket was a major milestone creating electronic ID-card usage. The solution's uniqueness was in that, due to the small population and concentrated knowledge, the certificates of the ID-cards as well as the ID-ticket database are held and maintained by the same authority – Certification Centre.

The general idea of the ID-ticket was simple: the personal ID-code is used as an identifier for the ticket. Each ticket sold had its owner's ID-code related to it; for ticket enforcement, the ID-code from the card could be read automatically so that the enforcement procedure contained:

1. Reading the ID-code from the chip of the ID card;

2. Sending the ID-code for validation;

3. Receiving and displaying the ticket validity answer received from the ID-ticket server.

Persons not having an Estonian ID-card could only use paper-based tickets.

The main drawback of the previous system was a lack of feedback to transport planners and managers on usage of PT. The users' acceptance of the ID-based ticketing was high due to not having to present the ticket on entering the PT and exemption from registering a trip.

B4   Actual implementation of the measure

The measure was implemented in the following stages:

Stage 1: Preparation (June 2009 – June 2010) – study of the existing ticketing systems, preparation of Terms of references for Public tender.

Stage 2: Procurement (June 2010 - December 2011, 18 months) – Call for tender, dialogues with 5 applicants, the final Call for tender, selection of successful tender; handling of appeals in 3 levels of court; second selection of successful tender, appeal and its rejection, signing the procurement contract.

Stage 3: Installation of system (December 2011 – August 2012) - creating the software, installing the required equipment (on-board computers, validating machines, printers) in selected buses, initial testing of the system.

Stage 4: Dissemination campaign (March 2012 – September 2012) – designing of the posters and stickers for bus shelters and inside vehicles, design of a special campaign bus, press conferences and interviews for newspapers, radio stations and TV channels, awareness campaigns in different city districts.

Stage 5: Public testing of the system (August 2012 – December 2012) – The system was installed in all public vehicles but was not compulsory for passengers

Stage 6: Full scale use (January 2012 -) – The new ticketing system and validating became compulsory except for ID-card based tickets users until March 2013.

B5   Inter-relationships with other measures

The measure is related to other measures as follows:

- **TAL 2.1 Developing P&R and School Bus** – P&R requires flexible and specialised ticketing to be effective. Introducing a flexible ticketing system creates possibilities for improving the P&R service. Also, getting additional information on the usage of P&R services through a trip registration helps to optimise the service.

- **TAL 2.3 PT Communication System** – The systems are partially sharing the same hardware in PT vehicles.

- **TAL 4.1. Mobility Management and marketing activities directed at popularizing usage of active transport modes** – Marketing activities were needed for raising awareness and acceptance of the new ticketing system. Information on PT usage is useful for both mobility management and marketing in the future.

- **TAL 8.3 Real-time information system** – The systems partially share the same hardware in PT vehicles. The mobile application of the real time information system was created by the company responsible for implementing the ticketing system. The application was created for supporting the popularity and usage of PT.

C Impact Evaluation Findings

C1 Measurement methodology

C1.1 Impacts and Indicators

Only the direct impacts of the measure could be evaluated for two main reasons. First the implementation of the measure was late and the new PT ticketing system was taken into full use in March 2013 – after the end of MIMOSA project. This means that there was no time to evaluate the impact. Second, other factors such as introduction of fare free PT from January 2013 had considerably larger impact on PT usage and the impact of the new ticketing system would have been virtually impossible to separate. Generally this is the situation with transportation system elements, the impact is a bundle of several factors that cannot be usually separated.

Table C1.1: Indicators.

NO	EVALUATION	EVALUATION SUB-CATEGORY	IMPACT	INDICATOR	DESCRIPTION	DATA /UNITS
4	Economy	Operating Costs	Operating costs	Change in operating costs of ticketing system	Operating costs of a whole ticketing system, old and new	Collected, €
15	Society	Acceptance	Awareness	Awareness level	Degree to which the awareness has changed	Index, qualitative, collected, survey
16	Society	Acceptance	Acceptance	Acceptance level	Attitude survey of current acceptance	Index, qualitative, collected, survey

Detailed description of the indicator methodologies:

- **Indicators 15 and 16, awareness and acceptance** – the evaluation of change in awareness and acceptance of the PT ticketing system was based on the general MIMOSA before phone survey in November 2009 and a separate combined source after-survey in September 2012.

  The **general MIMOSA survey** was planned and carried out by a professional market research company OÜ Klaster. Sufficient sample for different MIMOSA measures purposes was calculated to be between 600-800 persons.

  The **before-survey** was carried out in November 2009 and had a random sample of 1014 persons between ages 14 to 75. The survey was based on landline phone interviews and was carried out in Estonian (mother tongue for 53% of the population in Tallinn) and Russian (42%) languages. 25% of the sample was questioned by mobile phones to retain representability, because the usage of land line phones has decreased during the past decade. The sample was based on the population registry data and was gathered from all 8 city districts of Tallinn. The quotas of ages and sexes were calculated within districts. The quotas of 2 smaller of the 8 districts were above proportional because a minimum of 100 respondents was planned for every district. This was compensated with using different weights for different districts when calculating overall city results. The questionnaire was programmed by CATI (Computer Assisted Telephone Interviewing) and all interviews were performed using the system. The gathered data was checked in three stages: structural control – the CATI directed the interview to right blocks with help of filter questions; formal control – after the survey the errors in open text answers and numerical answers were corrected; cleaning the data – incomplete answers and interrupted interviews were removed in the process of cleaning.

The social profile of a respondent was based on gender, age, nationality, district of residence, car ownership and transportation mode use.

The general MIMOSA survey had 4 questions about PT ticketing system:

1. Are you aware of planning of a new ticketing system in Tallinn so that old paper based tickets will no longer be used?

2. How necessary do you think it is to replace the existing system with a new one?

The question 1 was used for evaluating the awareness and the question 2 for acceptance of the new PT ticketing system.

The after-survey was carried out in September 2012 and it had a random sample of 1000 persons selected according to the same principles as described above. The questions in the after-survey were the same as in the before-survey. The reason for not asking about other solutions was that they became operational after the end of the evaluation period and public was not aware of the details of different solutions in the time of the survey.

Table C1.2: List of potential effects that were not assessed

Impacts category	Indicator	How does it impact	Why it was not assessed
Transport	Quality of Service, Accuracy of timekeeping	The new system has a potential impact on the speed of validating and thus the speed of entering to PT will probably be affected.	The indicator was originally included in the evaluation plan. Since the previous ID-card based system did not require trip validating, the impact is not clearly positive. Also, the system became partly operational only a month before the end of the evaluation period, eliminating any possibility to evaluate its physical impact.
Transport	Modal share	The increase of quality and comfort of PT service affects modal share	The system became partly operational only a month before the end of evaluation period thus cannot have any measurable effect. Even in case it was fully operational, the ticketing system only has limited effect to modal share of PT compared to other factors.
Transport	Usage of new ticketing system	The usage of the system while old ticketing methods are still available in parallel show acceptance of the new system in practice.	The system became partly operational only a month before the end of the evaluation period, eliminating any possibility to evaluate its physical impact.
Society	Acceptance of Transport planners	The ticketing system was created for getting information on PT usage and transport planners/consultants can give qualified assessment on the system from this point of view.	The ticketing system alone does not guarantee any changes in PT, thus it is not only the question of getting the information. Also, the output from the system - its form and quality was not yet known before the end of the evaluation period.
Society	Acceptance of the particular new system	When people have actually used the system, their acceptance usually differs from general opinion.	The system became partly operational just one week before the second survey and initially the number of people using the system was very low. Thus the share of such persons with random sample phone survey would have been too small. Since the system had several failures in the beginning, getting a neutral acceptance would have required at least several months of stable operational mode, preferably after the parallel existence with the old systems had ended.

C1.2 Establishing a Baseline

The baseline for public awareness and acceptance was fixed with a before-survey in November 2009. The baseline for ticketing system operating costs was taken as the last full operating year of the old ticketing system – 2011.

C1.3 Building the Business-as-Usual scenario

The BAU scenario was based on an assumption that without issuing and promoting the new ticketing the public acceptance of the system would not have changed. The BAU scenario for ticketing system operating costs was based on an assumption that without the measure the operating costs would have remained on the same level.

C2   Measure results

C2.1   Economy

The old ticketing system costs consisted of ID-card based system costs and paper based system costs, all together 1,5M€ a year. Operating costs of the new system were fixed with a contract for four years for 2,15M€, i.e. 0,54M€ a year.

Table C2.1.1: Annual operating costs of ticketing system

Indicator	Before (date)	B-a-U (date)	After (date)	Difference: After –Before	Difference: After – B-a-U
4 Annual operating costs	1,5 M€ 2011	1,5 M€ 2012-2015	0,54 M€ 2012-2015	-0,96 M€ (-64%)	-0,96 M€ (-64%)

The operating cost reduction was a remarkable 2,8 times (-64%), which was somewhat surprising. Such a good result was not expected from the procurement where technical requirements were high and strict.

While the cost reduction result is good it gave no direct benefits for the PT users since fare free PT was introduces simultaneously but independently in January 2013.

C2.5   Society

Change in awareness and acceptance of general public was measured with surveys before and after the measure implementation. The awareness was measured with the question: "Are you aware of planning of a new ticketing system in Tallinn so that old paper based tickets will no longer be used?" The results from surveys are presented on the Figure 3 and Figure 4.
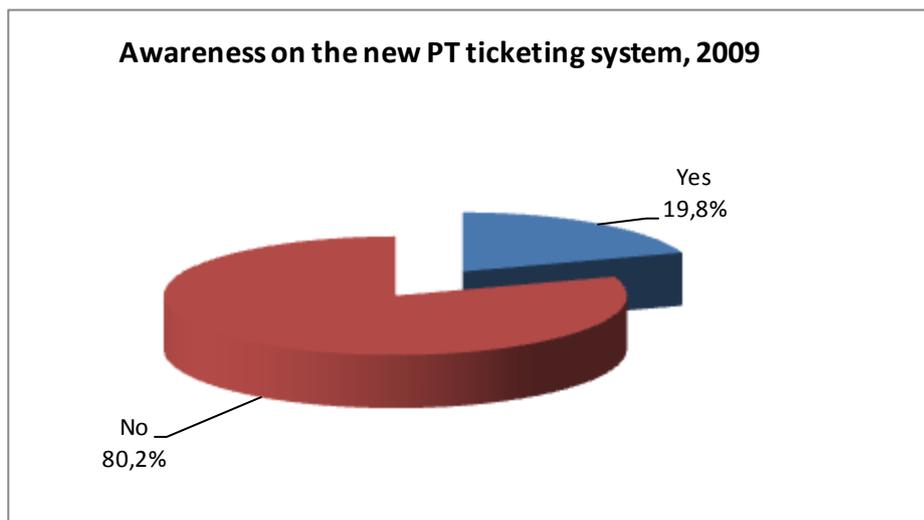

Awareness on the new PT ticketing system, 2009

Yes 19,8%

No 80,2%

Figure 3 Awareness of the new PT ticketing system before measure implementation
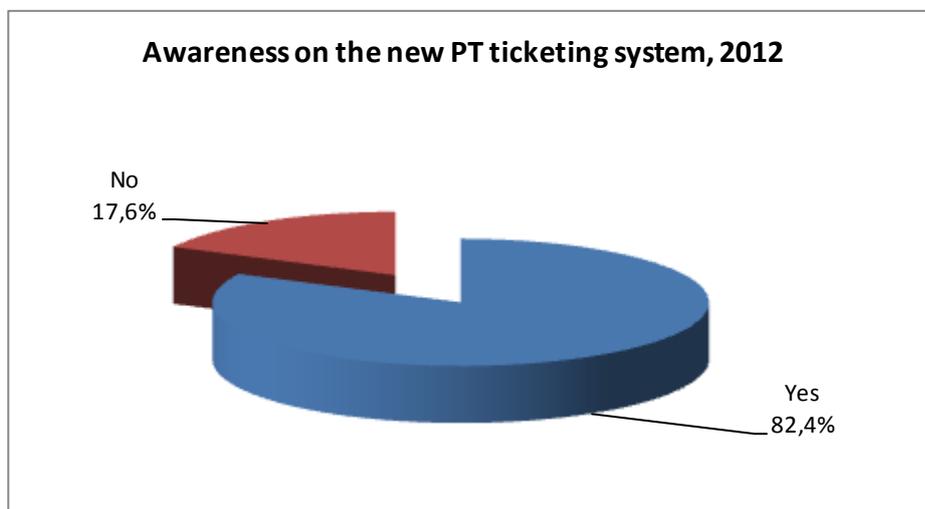
Figure 4 Awareness of the new PT ticketing system after measure implementation

As a result of the measure activities the awareness was increased 4,1 times - from 19,8% to 82,4%. Such large change in public awareness was logical, because the new system had just become operational one week before the second survey; information about the new system had been repeatedly displayed in national and municipal newspapers, TV and radio. Also just before the system became operational, a campaign was carried out in cooperation with the measure 4.1" Mobility Management and marketing activities directed at popularizing usage of active transport modes" for introducing the new system. At the same time the result indicates that the dissemination activities have been effective.

Acceptance of the new ticketing system was measured with the question: "How necessary do you think it is to replace the existing system with a new one?" The results from surveys are presented on the Figure 5 and Figure 6.
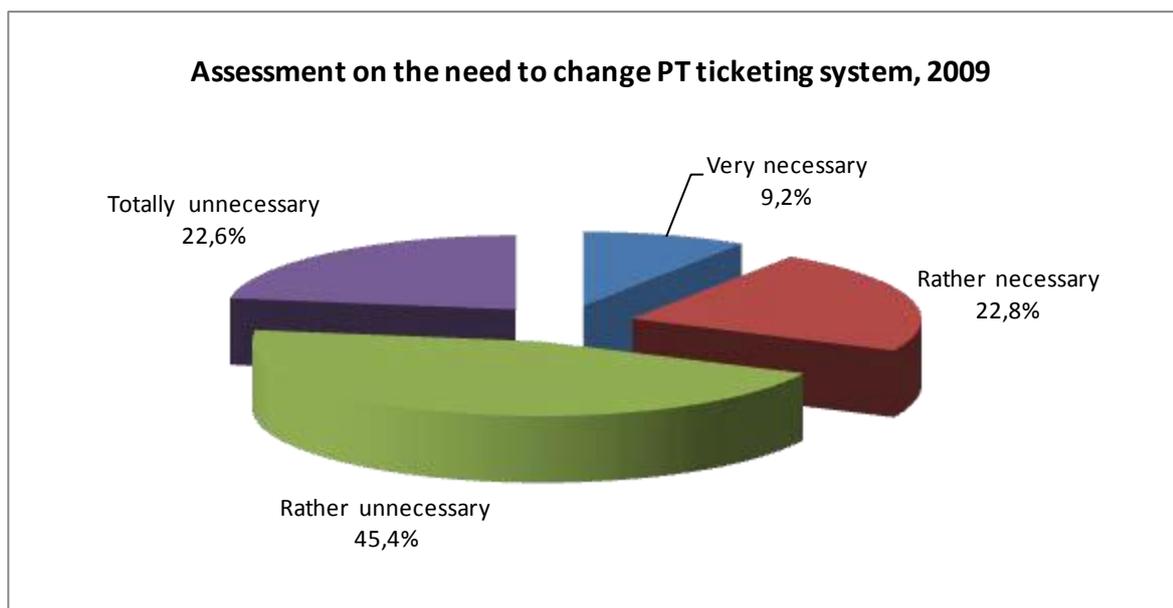

Figure 5 Acceptance of the new PT ticketing system before measure implementation
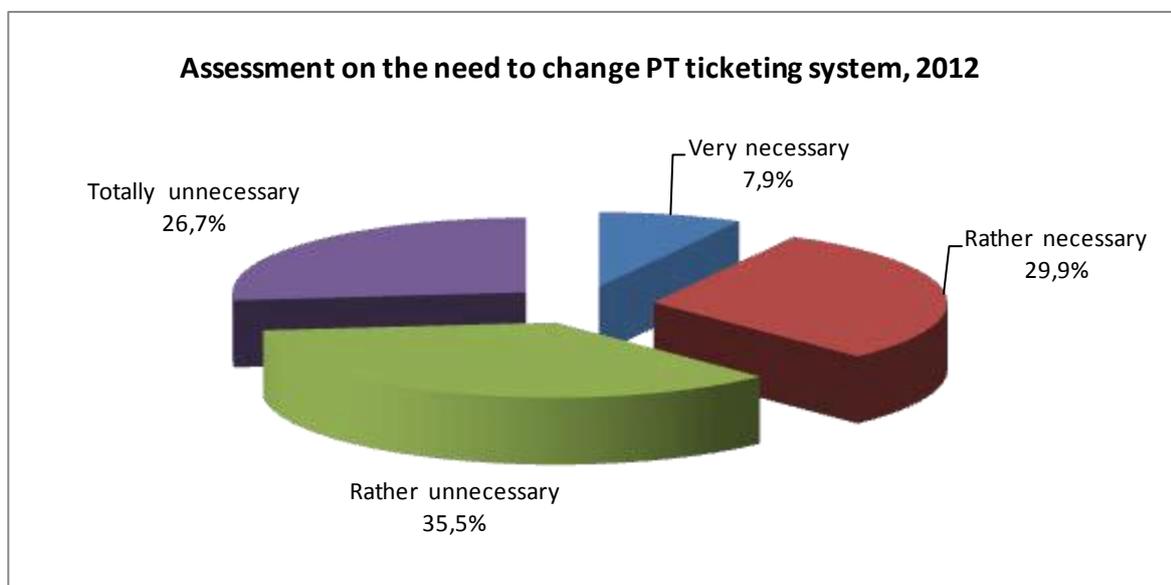
Figure 6 Acceptance of the new PT ticketing system after measure implementation

The change in acceptance of general public of the new PT ticketing system was an increase from 32% positive acceptance to 37,8% positive acceptance. The small change in acceptance is possibly caused by the plans to introduce fare free PT from January 2013 and many thought that the new ticketing system is connected to the fare free PT.

For acceptance, the 32-38% positive result is rather low. This is understandable because there was a functioning and very comfortable ID-card based system in use in Tallinn for years. Also, some people understood already before seeing the system what the new ticketing system would mean to the user – validating every trip. If the survey would have taken place in January, the acceptance would have been probably several times lower – since January 2013 the uncomfortable validating (compared to the situation before) became compulsory and with higher load the system encountered problems. Also, the National Data Protection Inspectorate discovered several discrepancies of the database and measure implementation with privacy and security rules which were widely spread by the press.

Table C2.5.1: Awareness and acceptance of the new PT ticketing system

Indicator	Before (date)	B-a-U (date)	After (date)	Difference: After –Before	Difference: After – B-a-U
15 Awareness	19,8%	19,8%	82,4%	62,6%	62,6%
	11.2009	09.2012	09.2012		
16 Acceptance	32,0%	32,0%	37,8%	5,8%	5,8%
	11.2009	09.2012	09.2012		

C3   Achievement of quantifiable targets and objectives

No.	Target	Rating
1	PT users awareness and acceptance of new ticketing system increased by 20%	★★★
2	Decreased costs for ticketing system maintenance by 15%	★★★
	NA = Not Assessed O = Not Achieved ★ = Substantially achieved (at least 50%) **★★ = Achieved in full ★★★ = Exceeded**	

The quantifiable results were both exceeded with the measure: while acceptance was increased only by 18%, awareness was increased 4,1 times, thus when handled together, exceeded clearly the target of 20% increase. Increase in awareness is logical after promotion and implementing and needs no further explanation. The relatively small acceptance before measure implementation is also understandable, because the cost and details of the future solutions were not known. The modest increase in acceptance means that after understanding what the measure is about, it is not generally accepted as a necessary measure. The system needs possibly time and real PT service improvement actions by the City based on the obtained usage data to get higher acceptance. The new PT ticketing system has been promoted as a need for passenger trip information for traffic planners but it has been never stated clearly what and when will be done for improving the PT system after getting the information.

C4   Up-scaling of results

The contactless ticketing system has very wide possibilities for up-scaling. Several contactless ticketing systems have been implemented for PT in other cities and counties of Estonia, some of them by the same company. It is also possible to interconnect with similar systems in other countries. The contactless card can be used virtually for any service or validation; it is just matter of adding the functions to the existing system.

The second important up-scaling possibility is the Near Field Communication system, that is currently (2012) being introduced with some of new mobile phones. This eliminates the need for separate contactless cards and makes using the system more comfortable for users who are interested in making their payments and validating with their mobile phone.

C5   Appraisal of evaluation approach

The evaluation approach was capable of showing some of the changes the measure caused. These were significant decrease in annual costs of Tallinn PT ticketing system, very high increase in awareness and modest increase in acceptance. While the changes in costs and acceptance by the general public are important results of the measure, the value of knowing the increase in awareness of the new system after implementing and promoting it in full scale is somewhat lower. Still it indicates that the dissemination activities have been successful.

It would have been useful to be able to evaluate the impact of the new ticketing system to the whole transportation system (including PT) but there were several reasons why this was not possible. The most important is of course the fact that the new ticketing system became operational just one month before the end of project evaluation period. Secondly, the new ticketing system is in parallel use with the old one until March 2013 and has thus limited usage. Finally there is a decision to introduce full scale fare-free PT for residents of Tallinn from January 2013, which has an undeniably bigger effect on transportation system than PT ticketing can possibly have and these effects cannot be separated

from each other. There are also secondary effects after the PT usage information is available for traffic planners but these effects take even more time to evaluate - probably years.

C6   Summary of evaluation results

The key results from evaluation results were as follows:

- **PT system annual costs reduced considerably** – running costs for Tallinn PT ticketing system were reduced by 64%;

- **Awareness of the new PT ticketing system increased considerably** – awareness of the new PT ticketing system was increased 4,1 times;

- **Acceptance of the new PT ticketing system increased moderately** – positive acceptance of the on the new PT ticketing system was increased by 18%;

C7   Future activities relating to the measure

There are several planned future activities related to the measure:

- The old ticketing systems are functional along with the new one until March 2013, from then on the new contactless ticketing system remains as the only possibility to use PT in Tallinn. The new ticketing system will be expanded for the whole Harju County in 2013.

- Users can validate the trip permission or purchase tickets by contactless credit cards after issuing these cards by banks in Estonia (probably in second half of 2013).

- A new tourist card will be based on the same contactless card system from January 2013, making it possible to use PT with the card. The old system was similarly to PT ticketing system paper based.

- A fare-free PT will be introduced from 1 January 2013 in the whole Tallinn PT system. It will be fare-free only for residents of Tallinn and requires trip validating.

- A support for NFC compatible mobile phones will be implemented probably in 2014 so users of NFC compatible mobile phones do not need extra contactless cards for using PT in Tallinn.

D   Process Evaluation Findings

D.1   Deviations from the original plan

The deviations from the original plan comprised:

- **Delays in implementing the measure** – due to appeals by bidders to the results of public tender the execution of the procurement contract was launched 10 months later than planned.

- **Omitting of expected results from the objectives** – the expected results (1) "Increased ticket revenue by 5%" was omitted from the objectives when it was clear that the new system was to be fully operational just before the end of the MIMOSA project, thus not enabling evaluation of the results. Both revenue and maintenance require at least a half year period for evaluation, even better if it is one year. Also, the decision to introduce fare-free PT for residents of Tallinn made the objective pointless;

- **Cancelling the idea of stationary ticket selling machines -** Originally there were plans for some such machines but the cost of them turned out to be too high and it was decided to use internet and mobile based sales.

- **No need for compatibility with future Harju county PT ticketing system** – instead of the need of being compatible with future Harju county PT ticketing system, the systems were treated together in the same procurement, thus the sometimes complicated need for future compatibility was eliminated;

- **Increasing the number of equipped vehicles** – as result of public procurement and due to the fact that 145 buses were equipped with requested equipment during the implementation of MIMOSA measure 2.3 PT Communication System, the number of PT vehicles equipped by financial resources of the current measure budget was increased. 171 buses instead of 100 were equipped with all requested devices, including 574 validators and 40 control devices.

- **Joint ticketing system instead of separate ones** – during the preparation work and negotiations with partners a decision was made to create a joint ticketing system with Harju County (around Tallinn city) and Tallinn Card (for tourists), based on a contactless card system with the same protocol as for PT ticketing system.

- **Wider range of cards** – it was planned to use only the brand new contactless card for validating tickets. As some student cards (ISIC, selected schools) were created on the same *Mifare* basis, owners of these cards can use them without the obligation to purchase a new card.

D.2   Barriers and drivers

D.2.1 Barriers

Overall barriers

- **Problem related barrier** – Difficult to choose the most suitable and competitive solution for City of Tallinn. This delayed preparation and execution of the procurement process.

- **Problem related barrier** – Opposition from some politicians at the state and city level because the new ticketing system is a rival to state level promoted electronic ID-card based systems and is not likely to be directly popular among PT users. This did

not directly impact on the measure results but was experienced as a barrier despite that.

Preparation phase

- **Problem related barrier** – Finding universal solutions for a joint ticketing system, which would satisfy the requirements of Tallinn PT, Harju county's PT and Tallinn Card was difficult. This made the preparation phase difficult.

- **Problem related barrier** – Unpredictable technical obstacles to synchronise current ID-ticket with new e-ticket. This made implementation and keeping schedules difficult.

Implementation phase

- **Institutional barrier** – due to appeals from different bidders a 10 months delay occurred during the public procurement procedure. This automatically delayed implementation of the measure;

- **Problem related barrier** – Installation of a brand new and never before tested ticketing system, for which special software and validating devices were both produced (locally in Estonia), needed more time resources than planned during the limited time scale of project.

Operation phase

- **Planning barrier** – Technological problems, daily issues with system software due to too limited a time for testing. The occurrence of problems is normal but due to delays with the procurement the planned implementation time was too short for solving the problems;

- **Political / strategic barrier** – PT users were not motivated to join the new e-ticketing system, because the ID-ticket was more convenient and still in use (until the end of March 2013). This was caused by the decision to keep the old PT ticketing in parallel for some time but is understandable because new systems usually have trouble being accepted and people still have old paper tickets.

D.2.2 Drivers

Overall Drivers

- **Positional driver** – The measure concerned was part of the Sustainable Development Plan of the city and a consequence of the implementation of a sustainable vision;

- **Technological driver** – New potentials offered by technology, new technology available. The measure result was only possible thanks to the new technology.

Preparation phase

- **Financial driver** – Availability of public funds (especially CIVITAS funding);

- **Problem related driver** – Common understanding between stakeholders on the specialist side on usefulness of the measure for getting PT usage information for transport planners.

Implementation phase

- **Planning driver** – Due to accurate technical planning and detailed terms of references for procurement, installation of the new PT ticketing system was carried out without critical problems;

- **Political / strategic driver** – Political support on city level during the appeals from bidders helped to get the process to a successful end.

D.2.3 Activities

Overall activities

- **Planning activity** – Due to the barrier 1 and the driver 2 the competitive dialogue procurement procedure was organised for collecting more technical information from different companies and for preparation of the more detailed terms of references.

- **Involvement, communication related activity** – Due to the barrier 2 and driver 1 a series of meetings were organised with politicians on the state and city level for getting support for the new ticketing system.

Preparation phase

- **Institutional activity** – Due to the barrier 1 a joint working group was created for getting the best solutions in the preparation process of the Terms of references for launching the Public tender.

Implementation phase

- **Involvement, communication related activity** – Due to the barrier 2 a supporting testing group was created on city government level for achieving the best results in a limited time.

D.3 Participation

D.3.1. Measure Partners

- **City of Tallinn** – Leading role in the measure implemented by the City Transport Department, responsible for the organising of PT in the city and City Enterprise Department, responsible for the organising of Tallinn Card for tourists;

- **Tallinn University of Technology** – A principal partner, responsible for evaluation of the measure;

- **PT Centre of Harju County** – A principal partner, responsible for the organising of PT in Harju County.

- **Ühendatud Piletid AS (United tickets LTD) -** A principal partner, responsible for the production of software, installation of devices for the new e-ticketing system and organising the marketing campaign.

D.3.2 Stakeholders

- **Public transport users** – the measure was directly aimed at them;

• **Disabled people** – these people will get contactless cards free and they have also to validate the tickets;

• **Visitors** – they have to buy the contactless card or Tallinn Card, but after the next step of development of the system they can use contactless credit cards and NFC compatible mobile phones.

• **Transport planners -** automated collection of PT usage statistics enables better PT capacity and route planning.

• **Residents** – as one of the measure objectives (and results) was decreased costs for ticketing system maintenance, citizens of Tallinn were on the beneficiary side.

• **Commuters -** the new PT ticketing system is the same for inner town PT lines and regional PT lines. For those who commute only with inner town lines, the situation will be less comfortable than it is now.

• **General public** – as the electronic ticketing system has been created on an open platform, all others Estonian regions and towns have the possibility to join with the system.

D.4   Recommendations

D.4.1 Recommendations: measure replication

• **The contactless card as a solution with minimum data** - the card (Mifare Plus) is inexpensive but safe and secure in the current case, as only unique ID number without any personal data or information is saved on chip. All personal and sensitive information is saved on the central server of the system. All information, needed for validating or purchasing the tickets is also saved on computers onboard PT vehicles. The measure is easily replicable for cities that want to create an online ticketing system and can keep communication costs at a low level.

• **Ticketing system on the open platform** – the measure is easily replicable for cities that want to join with other cities and regions and interested parties (one card for all). After logging into special ticketing site persons have possibility to buy tickets to/in different regions and to prove their right for using PT services with the same card.

D.4.2 Recommendations: process (related to barrier-, driver- and action fields)

• **More time, less troubles** - implementation of a complicated and large-scale measure in a limited (4 years) project time has a high risk of failure. The call for tender and terms of references were thoroughly prepared, but some "trivial" inaccuracies gave bidders the chance to appeal the results of the procurement, followed by a delay of 10 months.

• **Get political support** – time spent for explaining to politicians the usefulness of the measure gives return in difficult moments of the project.

• **Do not try to "reinvent a wheel"** – other European cities have implemented many similar measures, learn from others!

TAL 2.2 Public Transport Ticketing System

Reference Measure	TAL 2.2 Public Transport Ticketing System
Date of Submission	31/01/2012
Date of Review (ISIS)	04/2012
Date of Approval	04/2012
Author(s)	Tiit Laiksoo, marek Rannala
Editor(s)	Loredana Marmora (by ISIS)

Context and Purpose

The measure is aimed at creating new modern electronic online ticketing system for all types of public transport tickets in Tallinn and Harju county around it. All existing paper-, mobile- and ID-card based tickets will be replaced, from on trip, one hour and on day tickets to monthly period cards. With the new system all users have to validate their tickets only at the beginning of their trip compared to today's validation for paper tickets only.

The system enables to manage effectively different types of tickets, create cross-usage between different systems and to implement changes in fares without rouble of printing new tickets. The most important effect of the system is that it gathers anonymous and geographically precise information on users trips and enables therefore to get valuable information for transport planners without extra cost.

As the management of paper tickets is of same magnitude with the new electronic online ticketing system, the possibility to obtain continuous mobility data without costly studies adds to feasibility of the measure.

An overview of the available systems was needed before starting procurement process for electronic ticketing equipment. Originally there was no RTD planned for the measure but a workshop was held in order to find adequate answers to raised questions.

Description of RTD Activity

A workshop was organised with moderator from CIVITAS VANGUARD for presenting examples from the city of Ljubljana and TransLink Systems in Holland. Participants were from City of Ljubljana (Slovenia), Emilia-Romagna region (Italy), different departments of Tallinn Municipality, Road administration and private companies as possible bidders in procurement process.

Topics of the workshop concerned choice of contact free card based on various technical parameters, location of information (on card, in database or in vehicle), identification, integration of other uses for the card both different functions and different regions, availability of statistical information from the system, cost, risks with procurement process. The topics were analyzed, discussed in groups composed by different stakeholders and results presented to all participants.

Outputs and Results

Two principally different systems were chosen for consideration as a result of the workshop. Ljubljana has typical closed system with high security level, Holland has "1 card 4 all" principle

which gives virtually unlimited possibilities to use the card. It was started in Amsterdam and Rotterdam and now is in use in all regional trains of Holland.

Resulting Decision-making

The Holland system was found to be more suitable for implementing in Tallinn. Procurement was prepared based on the results from the workshop. The system includes Tallinn public transport, transport of Harju county around Tallinn and tourist-oriented Tallinn Card .

Lessons Learnt

Technically it was relatively simple to arrange the workshop and it did not require much resources.

Very little interest and participation from other Civitas cities was surprising. Program of the two-day workshop should have contained more presentations with experiences (especially negative) from different cities.

Discussions on impact of the system on different stakeholders in Tallinn, on different financial and political aspects were not as useful as the examples and experiences from other cities. This has proved to be true in preparing the procurements.

Cost-effectiveness

Budget of the workshop was small: rooms were free (owned by the city), the costs were catering, accommodation of some presenters, most of guests covered their expenses themselves. Therefore the result can be considered as cost-effective.

Dissemination and Exploitation

Tallinn city government issued a press release about the workshop and it was covered by national newspapers and websites and in CIVITAS newsletter.