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ARE WE READY FOR SMART TRANSPORT? ANALYSIS OF ATTITUDE TOWARDS PUBLIC TRANSPORT IN BUDAPEST

János Imre Mezei[1,] * and Kornélia Lazányi[2]

[1]Óbuda University, Doctoral School of Safety Science
Budapest, Hungary

[2]Óbuda University, Keleti Károly Faculty of Economics
Budapest, Hungary

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ABSTRACT

In every case of serious development that concerns the majority of society, it is vital to analyze the current social opinion on the particular service and to analyze the possible effects, that the elements of the system being developed, could have. This is no different, when it comes to smart cities, more specifically smart traffic systems, even if these developments are to serve the improvement of people's living conditions. It is essential to determine what the decisive factors are for the man of today in choosing a mode of transport; which attributes influence that decision; what sort of opinion that individual has about different urban modes and whether he/she is ready to utilise smart means of transport. Furthermore,it is inevitable to explore, what would make people choose *smart* solutions (e.g. autonomous vehicles). Current article is to showcase the responses to the above questions of people living in the Hungarian capital, Budapest. The article begins with an overview of the international literature on smart cities and their transport system. Afterwards, the results of a research sponsored by the Hungarian Ministry of Human Capacities are presented, followed by the conclusions based on the results obtained.

KEY WORDS

smart transport, public transport, readiness, self-driving vehicle

CLASSIFICATION

JEL: L62, L92, O18, R00, R42

*Corresponding author, η: mezei.janos.imre@gmail.com; –;
Doctoral School of Safety and Security Sciences of Obuda University, H – 1428 Budapest, Pf.:31

INTRODUCTION

By 2050, over 70 % of the world's population is estimated to live in cities [1]. Municipalities are facing challenges unsolvable by present solutions, such as increasing the level of services – and through them the quality of life of the inhabitants - and at the same time improving the environmental quality [2]. For this reason the concept of smart cities is gaining ground very fast, since it promises to solve severe problems of urbanisation, such as traffic, pollution, waste management or resource efficiency. Mobility is one of the most relevant topics regarding smart urban solutions. According to the ENEA [3] already significant measures have been taken in this regard, improving fleet management and logistics processes of goods and public passenger transport facilities. Smart Mobility is fundamentally influenced and induced by modern info communication technologies used in both backward and forward applications, to support the optimisation of traffic instabilities and to provide more sustainable solutions [4].

THEORETICAL OVERVIEW

SMART CITIES

Most of the time the term smart city is defined through ICT used and its terminology [5]. It is regarded as a complex system of data, information and knowledge shared within and in-between the interconnected networks of citizens and organisations. In this aspect smart transport solutions are part of the digitalised infrastructure and are there to connect entities and to provide accessibility [6]. Nonetheless smart mobility is much more than that and is expected to infuse all territories of the smart city concept, influencing the life of all stakeholders with its competitive, green, sustainable and self-governing features [7, 8]. Bencardino summarised these expectations in six categories [9]:

- reduce traffic congestion,
- improve transfer speed,
- reduce transfer costs,
- reduce pollution,
- reduce noise pollution,
- increase safety.

However, ICT cannot provide solutions to people, unless people are eager to utilise the features provided by the smart solutions. Smart cities necessitate smart citizens who are curious and innovative and are willing to make use of the smart facilities. As Giffinger [10] defined it, the presence of "self-decisive, independent and aware citizens" is inevitable. Smart people are the clue of a smart transport system. Maturity to accept their own limitation in transfer freedom and to embrace shared or public solutions is a prerequisite that necessitates trust from the citizens [11]. ICT can only have significant impact on the quality of life of people in cities, if it does not require big investment on behalf of the citizens. Here it has to be noted that not only financial matters are taken into consideration, but the development of the necessary technological literacy and deliberate involvement may also be regarded as investment [12]. Hence, the aim of this article is to analyse the Smart Mobility readiness of people and to investigate the role of trust, and its building blocks in the creation of awareness about smart traffic solutions in the public transport and the value created through them. Faqih [13] proved that the perceived usefulness, trustworthiness and ease-of-use to have a direct impact on citizen behaviour. Trust also seems to play a decisive role in the adoption of new solutions, especially those heavily infused with ICT [14, 15]. Trust is important, since

citizens need to accept a certain extent of autonomy of vehicles and transport systems andconcede at least a part of their own control. Nonetheless primary research on the readiness and the trust issues regarding smart mobility are only limited and mainly focus on (semi-) autonomous cars [15-17]. Promoters of smart cities and smart facilities can only estimate the readiness of citizens for the future solutions. However, these estimations are important, since trusting behaviour can only be generated when sufficient amount of information is provided, and when the target group is deemed to be able to aggregate them into knowledge, and through the acceptance of change into wisdom [18].

RESEARCH

SAMPLE

We have assembled a standardized questionnaire, consisting of 15 + 4 demographic issues, in order to research general opinion on the public transport system of Budapest and on the acceptance of various autonomous vehicles. The choosing of the sample was random, using the snowball method, and ultimately 457 individuals filled out the questionnaire. Out of those 457 filled out, 450 were evaluated. In spite of this, the sample is not considered to be representative, since it lacks the size and the composition to be applicable to the base population, however it is adequate to observe fundamental correlations. The average age of participants is 24,29 years. The distribution of residence of the participants is 7,33 % village or municipality, 17,55 % small town, 10,66 % large town and 64,44 % capital, and all of them are involved in the public transport of the capital.

INCLINATION TO TRAVEL WITH VARIOUS AUTONOMOUS VEHICLES

To study the differences between groups, we were searching among independent sample t-tests to find the right methodology. Since there are different numbers of elements, considering the groups, we applied the Welch d-test as our test method. it, we examined, whether averages of the given variables deviated significantly. Only those results were presented, with which the Welch d-test proved a 95 % significance level of realization. During the tests, we were looking for answers on how an individual currently assesses a mode of transport, which in the future would be autonomous.

People who are willing to travel by autonomous tram and people who are not

First examined group consists of people willing to travel by autonomous trams and the people who are not, Table 1. A significant difference was detectable in two cases between the groups. The first was the opinion on the capital city tram system from a security point of view. In this case, those who are accepting of autonomous vehicles gave an average of 0,49 points more, than those who reject autonomous trams. The second aspect was the passenger-friendliness of trams, on which the acceptors gave an average of 0,37 points higher value. It can be inferred from this that acceptors feel that tram transport is safer.

People who are willing to travel by autonomous subway and people who are not

In case of the acceptance of autonomous subways, the four metro lines in Budapest were separeately studied, as they meet completely different technical standards. With metro line 1, significant deviations were found in 7 out of 8 attributes, between the acceptors and the rejecters, Figure 1. In each case, the acceptors gave a higher rating to the given attribute. The most prominent difference can be observed in security, where the acceptors rate the current state of metro line 1 on average 1,2 points higher, than the rejecters.

Table 1. Differences between people accepting and rejecting autonomous trams, concerning the current tram system. Independent Samples Test (autonomous trams).

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	*t*	d*f*	Sig. 2-tailed	Mean difference	Std. error difference	95% Confidence Interval of the Difference	
									Lower	Upper
Safety of Tram transport	Equal variances assumed	0,968	0,326	2,655	448	0,008	0,4902	0,1846	0,1273	0,8530
	Equal variances not assumed			2,605	206,386	0,010	0,4902	0,1882	0,1192	0,8612
Passenger Friendship of Tram transport	Equal variances assumed	0,113	0,736	2,179	448	0,030	0,3687	0,1692	0,0362	0,7012
	Equal variances not assumed			2,187	215,394	0,030	0,3687	0,1686	0,0364	0,7010

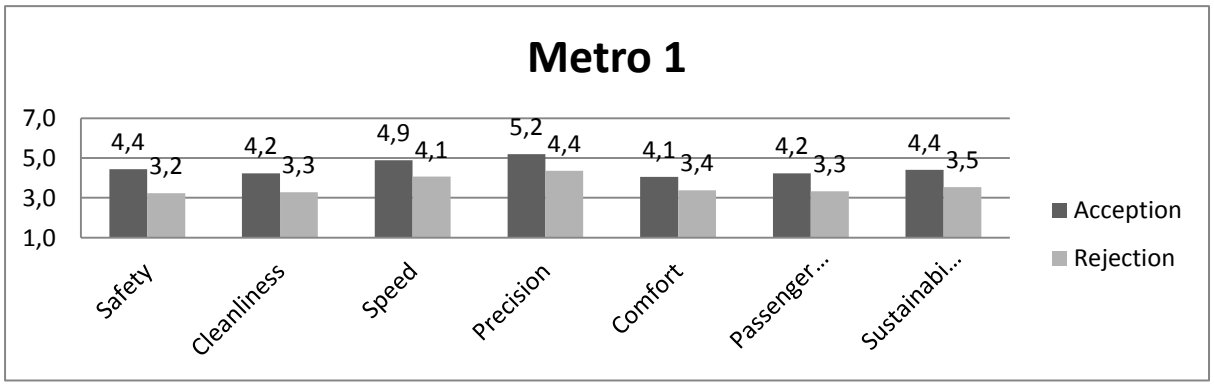

Figure 1. Differences between people accepting and rejecting autonomous subway, concerning the current metro line 1.

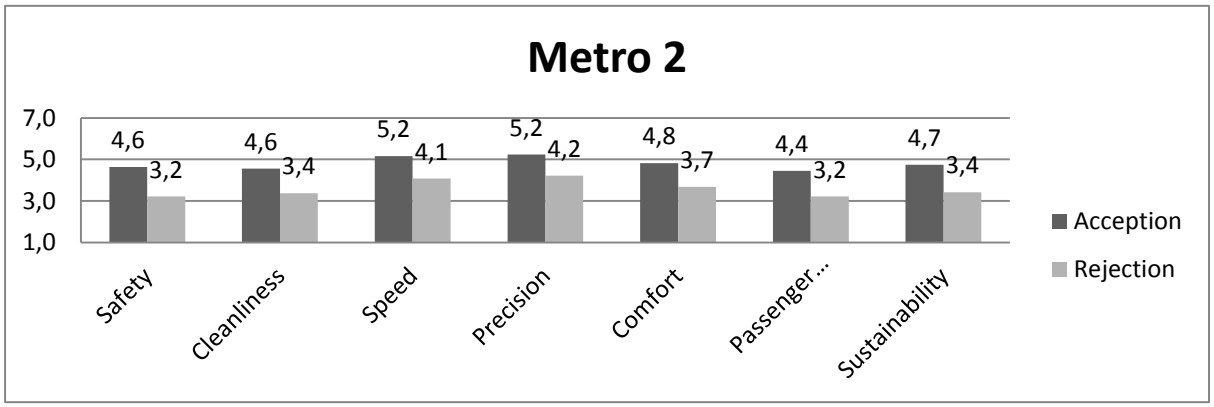

Figure 2. Differences between people accepting and rejecting autonomous subway, concerning the current metro line 2.

While observing the opinion on metro line 2, Figure 2, the same 7 attributes showed notable differences, as with metro line 1. However, it is also apparent, that between each rating, there

was at least 1 whole point in difference. From this we can deduce that the acceptors and the rejecters have a much sharper distinction, concerning metro line 2 travel. It is important to note, that with regard to the Grade of Automatization, metro line 2 qualifies for level 3, in which case it can almost be called autonomous, since the driver is mostly just a supervisor, and in charge of opening and closing the doors, but between two stations, the subway operates autonomously.

In case of metro line 3, notable differences were seen in 6 attributes, Figure 3. These were significantly less prominent, than with the other metro lines (no cases showed a difference of more than 1 point). It is important to point out, that the opinion on metro line 3 is by far the worst out of the 4 metro lines. Neither groups evaluated its security and cleanliness to the cumulated average of 3 points, from which it can clearly be concluded, that passengers are not satisfied with the quality of services, provided by metro line 3. Both the track and the subway cars have recently begun to be renovated. Prior to the start of the renovation, shutdowns were frequent in this line, which can partly be a contributing factor to the obtained results; furthermore during the reconstruction, the metro line has to be partially closed in several phases. Partly we attribute the results to these reasons.

Metro line 4 is the latest subway line in Budapest and completely autonomous. It is observable that all 8 attributes show significant differences, Figure 4. The most notable deviation was in the case of safety, where the average difference between acceptors and rejecters was 1.6 points. This clearly shows, that the people rejecting autonomous subways, mainly have a safety concern about traveling on a driverless vehicle, or are not trustung in these constructions as a whole. Overall, it is obvious, that metro line 4 had the best opinion among respondents.

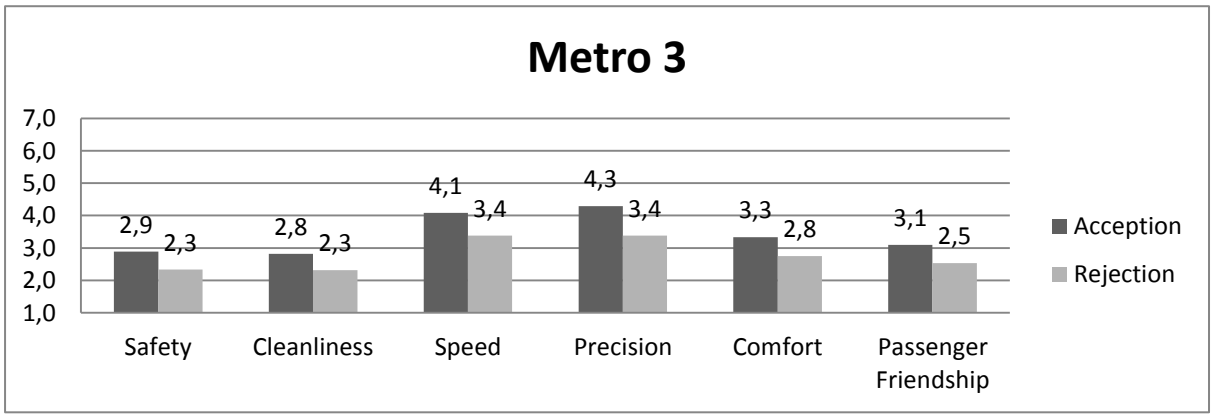

Figure 3. Differences between people accepting and rejecting autonomous subway, concerning the current metro line 3.

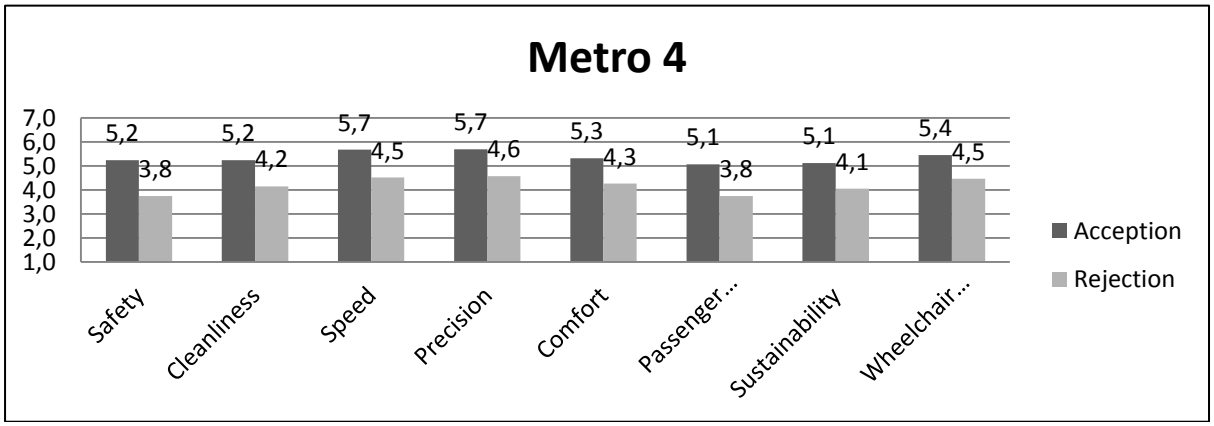

Figure 4. Differences between people accepting and rejecting autonomous subway, concerning the current metro line 4.

CONCLUSION

It can be stated that the spread of various *smart* developments and solutions will increase in urban infrastructure every year. According to this trend, the same applies to public transport. Seeing the obtained results, it can be concluded, that current opinions on tram and metro lines in Budapest are mixed, but overall these modes of transport show the highest amount of acceptance to convert into autonomous vehicles, according to the answers (70 % acceptance rate with trams and 86 % with subways). Based on the results currently obtained, it is absolutely necessary to carry out the research at a deeper level, in order to find out the cause and effect relationships about what makes a person accept autonomous vehicles in one mode of transport and rejects them in another.

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