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IMPACT OF e-SAFETY APPLICATIONS ON CYCLISTS' SAFETY

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Abstract

Cycling is the most energy efficient and environmentally friendly transport mode, suitable especially for short distances.

However, cyclists are considered as Vulnerable Road Users (VRUs) who show an high casualty rate; therefore, actions to promote cycling in cities should go together with improving road safety.

ITS can be used to develop intelligent applications assisting cyclists and other road users to avoid, prevent, or mitigate accidents.

This paper presents the results of the assessment of impacts of ITS on the safety of cyclists, realised in the framework of the EU co-funded project SAFECYCLE.

Eleven applications were selected and analysed in term of benefits and costs. The analysis allowed comparing the potential impacts of these applications in four EU countries (the Netherlands, Belgium, Italy and Czech Republic), having different mobility and social characteristics.

Keywords: *cyclists safety / cost-benefit analysis / e-safety / Vulnerable Road Users*

1. Introduction

Cycling is energy efficient, environmentally friendly and very suitable for short distances. At the same time, in 2009, around 2,100 cyclists were killed in road accidents in the EU-19 countries (around 7% of all fatalities) (ERSO, 2011). Therefore, actions to promote cycling in cities should go together with improving road safety. Apart from the traditional measures like a dedicated cycling infrastructure, improving visibility and reducing speed of cars, ICT can be used to develop intelligent applications that assist cyclists and other road users to avoid, prevent, or mitigate accidents. However, there is no integrated approach to research activities in this domain at a national or international level. To fill in this gap, the SAFECYCLE project, co-funded by the European Commission was started in 2011[3]. The main objectives of SAFECYCLE were to identify e-safety applications that have the potential to enhance the safety of cyclists in Europe, to create knowledge and raise awareness about e-safety applications applied to cycling (policy, industry, users) and to speed up the adoption of (new) e-safety applications in cycling.

E-safety here is defined as a vehicle-based intelligent safety system that could improve road safety in terms of exposure, crash avoidance, injury reduction and post-crash phases.

[3] The project SAFECYCLE – ICT applications for safe cycling was finished in November 2012. Results can be found on the website: www.safecycle.eu

2. Background

In Figure 1a the data related to modal share of bicycle use per country (from different sources and years) are presented. In many European countries there is not a good road infrastructure network for cyclists. Cycle paths are poorly maintained, dirty and not entirely safe. Often, cyclists are expected to share the road with fast traffic. This makes cyclists feel unsafe and does not encourage them to use the bicycle as a means of transport. Fig.1b indicates the deaths in traffic involving at least one bicycle, per million inhabitants in different countries in Europe. Almost 60% of the bicycle fatalities in the EU-23 countries were killed in urban areas. Anyway, there are large differences ranging from over 75% in Spain to 24% in Romania (ERSO, 2011).

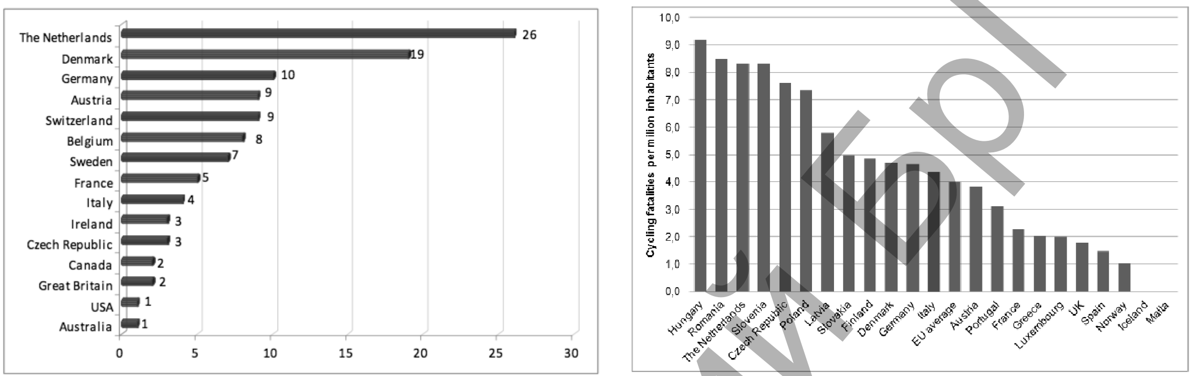

Figure 1: a) Bicycle modal share for all journeys per country4;
b) Deaths in traffic accidents involving at least a bicycle per mil.inhabitants
in Europe, in 2010 (CARE, 2012)

3. Overview of e-safety application

E-safety applications in cycling can be used to provide intelligent systems that assist in avoiding, preventing or mitigating accidents with cyclists. The following dimensions can be identified:

- Cyclists: applications addressed to the cyclist.
- Bicycles: applications addressed to the bicycle or have their main focus on the bicycle.
- Other vehicles: applications integrated in or used by other vehicles.
- Infrastructure: applications integrated in infrastructure or having their main focus on infrastructure.
- Web applications (Internet and Nomadic): applications used through internet or specific application on a nomadic device (smart phone).

Figures 3 shows different ICT applications for each dimension identified.

[4] **Sources:** Australian Bureau of Statistics (2007); Netherlands Ministry of Transport (2006); United States Department of Transportation (2003); Isfort Italian survey ‘Audimob’ (2006); Annex I: Literature search bicycle use and influencing factors in Europe– ByPad Project (2008). In: “Promotion of cycling”

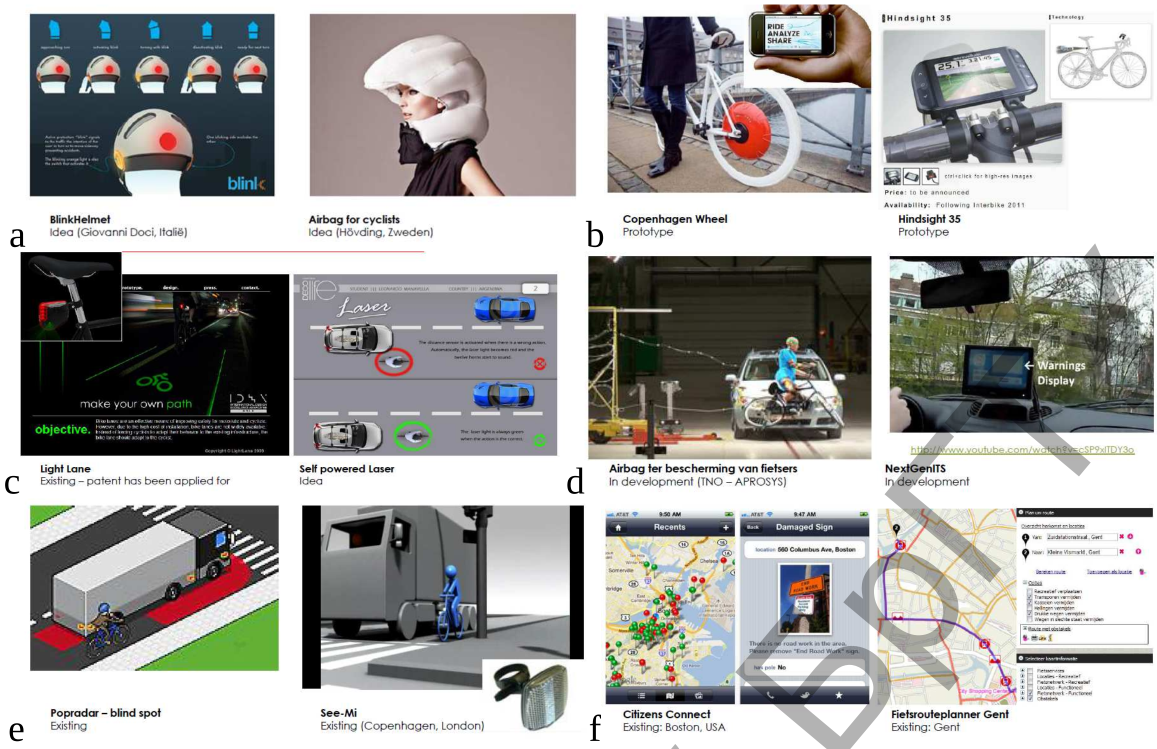

Figure 2 – a-f: Selected e-safety applications

More than 120 applications for cyclists were found (the search not only included Europe, but also other continents). Not all of the applications are in definition e-safety applications, but have the potential to increase safety in a smart manner. The list of e-safety applications was reduced to 30 applications that are representative of various categories. These applications were then assessed through a SWOT analysis. Cycling, ITS and road safety experts filled in many SWOTs, resulting in a list of applications from most to less promising in relation to increasing road safety for cyclists. Eleven most promising applications were identified and selected for the impact assessment (Tripodi et al., 2012). Table 1 shows the applications selected for the impact assessment. More information about these applications can be found in Zoer et al. (2012).

Table 1: List of most promising applications

Bicycle	**Other vehicles**	**Infrastructure**	**Internet**	**Nomadic**
HindSight (Phisycal problems)	*SaveCap - Car airbag for cyclists* (Airbag)	*Countdown traffic lights* (Traffic light)	*Routeplanner Gent* (Routeplanner)	*Citizens connect* (Monitoring and action)
Light Lane Bike (Street projection)	*ISA - Intelligent Speed Adaptation* (Speed)	*Traffic Eye Zürich* (Traffic light)		
Bicycle braking light (Visibility)	*Lexguard blind spot system* (Visibility)	*LED-Mark* (Visibility)		

4. Methodology

Due to the lack of impact assessments and real case tests on applications for cyclists, the assessment of the e-safety applications selected has been mainly based on a literature review of impacts on safety of similar measures (i.e. having similar effects on cyclists safety). For each of the eleven applications selected, a Cost Benefit Analysis (CBA) has been realized. This procedure allows for assessing the differences, in term of impacts, of the applications between the four selected countries. This especially allows understanding if (potentially) certain applications would be more cost effective to implement than others (i.e. if benefits are higher than costs) and in what countries applications could provide the highest benefits. The results of the CBA and the assumptions and estimations made were also assessed by international road safety, ITS and cycling experts.

5. Results

Table 2 shows the results of the Cost Benefit Analysis (i.e. the EU average values).In general, the applications providing the higher benefits are *Countdown* and *Light Lane Bike*.

Table 2 – Result of the Cost Benefit Analysis for the selected applications

Category	Name of application	Costs (mln €)	Benefits (mln €)	CBA
Bicycle				
Physical	HindSight	27,101	2,415	0.09
Street projection	Light Lane Bike	5,420	7,813	1.44
Visibility	Bike braking light	3,252	2,300	0.71
Other vehicles				
Airbag	SaveCap	51,744	2,302	0.04
Speed	ISA	103,548	2,521	0.02
Visibility	Lexguard	31,024	477	0.02
Infrastructure				
Traffic light	Countdown	363	9,219	25.38
	Traffic Eye Zürich	36	51	1.41
Visibility	LED-Mark	3,111	397	0.13
Internet (web)				
Route planner	Routeplanner Gent	44	334	7.67
Nomadic				
Monitoring	Citizens connect	44	334	7.67

Figure 3 allows comparing the results obtained. The dimensions of the circles in the figure give an idea of the Benefit Cost ratio, while the position of the circles give an idea of how much the application could reduce the severity of accidents (on ordinate) and the probability of event (on abscissa).

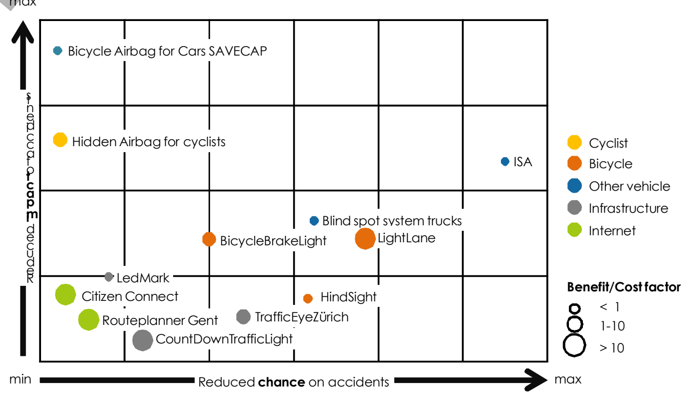

Figure 3 – Results of Cost Benefit Analysis for the selected applications

Although the results of the CBA are based on many assumptions and best estimates, the outcomes are hinting towards some conclusions:

• Applications that require installations in all passenger cars, such as SaveCap and ISA, result in a very low Benefit Cost ratio. This is caused by the fact that the systems need to be installed in millions of vehicles and therefore are very costly in total.

• The same applies for applications that need to be installed in trucks, such as Lexguard. On a European-wide basis, this requires an investment of hundreds of millions of euros.

• For the systems to be installed at the bicycles, two out of three seem to have a positive Cost Benefit ratio (i.e. Bicycle braking light and the Light Lane Bike). These are relatively cheap applications. On the other hand, the HindSight does not have a positive Cost Benefit ratio.

• The infrastructure-based systems show a mixed picture. The Countdown traffic light system has a positive Cost Benefit ratio for all four countries, but the Traffic Eye Zurich only seems to have a positive Cost Benefit ratio for The Netherlands and Belgium. For the LED-Mark system the expected costs are always higher than the expected benefits in all four investigated countries.

• Last but not least, it seems that the Internet applications, such as the Routeplanner Gent and the Citizens Connect, have the highest Benefit Cost ratio. With relatively little investment many potential users can be reached, which seems to result in a very positive Benefit Cost ratio.

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