Paper number ITS-XXXX

Preliminary findings regarding eCall after-market CBA

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Abstract
The present study takes into account two main aspects, respectively: the preliminary results of the Technology Acceptance Model (TAM) application to evaluate the intention of the potential consumers to purchase and use the eCall based on 112 devices on the vehicles they either own or drive; the preliminary results obtained as a result of the Economic Cost Benefit Analysis (CBA) implementation, to evaluate to what extent it is advisable to install the eCall after-market device on passenger vehicles driven on European roads. The paper demonstrates that a TAM-based model assessing drivers' intention to purchase/use an eCall after-market system has good predictive and explanatory capacity, and that in the CBA, a do nothing scenario is efficient regardless of the price set for the eCall IVS and in the do something scenario, the benefit/cost ratio is strongly influenced by the price level.

Keywords:
eCall based on 112, Total Acceptance Model, Cost Benefit Analysis

1. Introduction

In a general approach, the rhythm of economic and social progress has always been decisively influenced by the volume and quality of investment. Moreover, in any economy there are several key areas, which have a major impact on both the general welfare and the quality of life. From our point of view, one of these fields is transport, alongside health, education, scientific research infrastructure, leading industries, agriculture, environmental protection, etc. But, considering the objectives we have in mind for achieving the Cost Benefit Analysis (CBA) within sAFE project, we will refer mainly to road transport and to the need to continuously improve its safety.

From this perspective, the investments made to increase the safety of all participants when traveling by road have multiple effects, which we can classify into two main categories. On the one hand, we are referring to economic effects, such as: the improvement of the economic environment; the stimulation of growth in goods and service demand; the increase and diversification in offer; the increase of income and profits; encouragement in the movement of people and goods; accelerating the promotion and implementation of technological progress; improving the capacity of countries to participate in the international economic circuit; influencing the increase of economic efficiency at the level of all stakeholders. On the other hand, we are talking about social effects, such as: an increase in the quality of life and standard of living; creating new jobs; developing the cultural and educational level of individuals; increasing the quality of the workforce; the protection of the health and life of individuals; environment protection.

According to official studies and reports (Adminaité-Fodor, Heilpern and Jost, 2019, p. 9), the number of deceased people due to road accidents on EU roads in 2018 amounted to 25.047. This value shows that the number of fatalities decreased by only 1%, compared to the value recorded in 2017. Moreover, in the last five years, the average number of fatalities reduction was less than 1% per year, considering that the cumulative amount of road fatalities in the mentioned period is only 4%. Of the total number of European countries monitored by the ETSC Road Safety Performance Index (PIN) program in 2018, the number of fatalities has been reduced by almost 50%. The values recorded were significant in four countries, ranging from 10% (Bulgaria) to 15% (Slovakia). However, it is estimated that the recorded values are, unfortunately, far from the target for 2020, respectively 15.750 road deaths (euobserver, October 26, 2019), even if the trend is decreasing over a long period.

What we want to emphasize is that, after a long period of timid and unsatisfactory progress regarding the number of road fatalities and severe injuries, over a period of almost 10 years (from 2010 to 2018), concerns for this subject became very intense. Thus, starting with June 2019, one of the central elements of the regulatory framework of the EU Road Safety Policy is the concern for the performances recorded after an accident that results in fatalities and / or severe injuries. According to experts in this field, one of the elements that can make a significant contribution to reducing the severity of the effects of severe road accidents is the implementation of eCall-type devices in all vehicles and not only those manufactured since April 2018 (M1 and N1).

2. Brief description of eCall IVS

In this part of the study we will insist on detailing the concept of the eCall system, functionality of the function, the implementation of technologies or other technical and legislative aspects. However, in order to facilitate the understanding and quick assimilation of the information, we will briefly present a few of the main aspects regarding the significance of the eCall IVS.

In practice there are various definitions used for this concept. For example, eCall aims to automatically initiate an emergency call from a vehicle to an operator at the common emergency number 112 in the event of a road accident (Berg Insight, 2007). From a different perspective eCall IVS is a system that is installed in vehicles having the role of transmitting an emergency signal in the event of an accident, along with information about the location and about the accident itself (McClure, Forestieri and Rook, 2016). In short, eCall is an emergency system for vehicles based on the E112 system (Brembo, 2016, p. 5).

According to sAFE, eCall is: an emergency call that can be generated through being activated by the sensors inside the vehicle (following a collision) or manually by one of the vehicle's occupants; a free service for all European citizens; when activated, the eCall from the vehicle establishes a voice connection directly with the nearest Public Safety Answering Point (PSAP) and sends a minimum set of data (MSD) to the PSAP operator receiving the voice call.

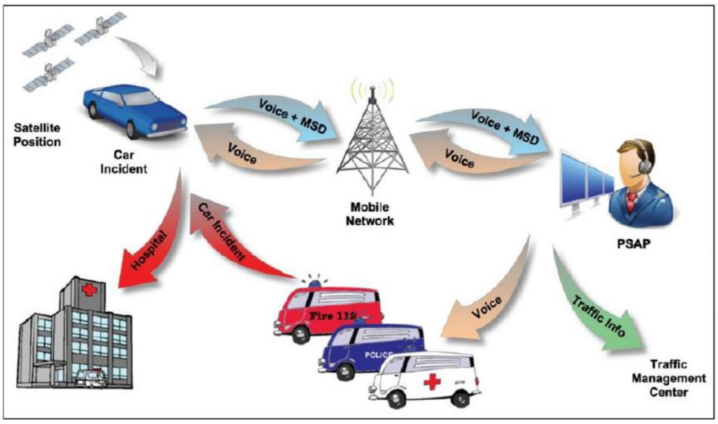

Figure 1: The operational cycle of eCall

Source: HeERO project, European Commission

Regarding MSD, they can be split into two main categories (Directorate-General for Mobility and Transport, 2019, pp. 17-18): MSD – static data, like Vehicle identification number (VIN); Vehicle propulsion storage type; Vehicle type; MSD – dynamic data, as Time stamp (trigger time); Vehicle location; Vehicle direction. The additional data needed to make the rescue measures more efficient are requested from the occupants of the vehicle by voice connection, to the extent that they can provide them (depending on the severity of the injury). In case the PSAPs operators cannot initiate and carry out a voice call with the occupants of the vehicle, because they have suffered very serious injuries or even died, standard rescue measures will be started, as they are usually carried out in these circumstances.

3. Previous research on eCall IVS based on 112

The process of choosing a research methodology (appropriate to the considered objectives) is not at all simple. The more complex the researched aspects and the larger scale the economic and social implications are on, the more difficult it is to identify the appropriate methodology. So, as a result of the literature review, it turned out that for the evaluation of the target group's opinion, the TAM model will be applied, and for the CBA implementation, the Economic Cost Benefit Analysis (ECBA) model will be applied, as recommended in the *EC Guide to Cost-Benefit Analysis of Investment Projects - Economic appraisal tool for Cohesion Policy 2014-2020* (December 2014) and not only. We should mention that ECBA has already been successfully applied in previous studies on the implementation of the eCall IVS device, carried out under previous actions, funded by the European Commission (as there are C-Mobiles, eIMPACT, HeERO projects, eMERGE, and others).

An important starting point in the realization of ECBA is to take into account the provisions contained in the European eCall regulatory framework, such as: *Directive 2010/40/EU of the European Parliament and of the Council of 7 July 2010* on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport entered into force, with the 'harmonized provision for an interoperable EU-wide eCall'; *Regulation (EU) 2015/758 of the European Parliament and of the Council of 29 April 2015* concerning type-approval requirements for the deployment of the eCall in-vehicle system based on the 112 service and amending Directive 2007/46/EC; *Communication to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions*, Europe on the Move, Sustainable Mobility for Europe: safe, connected and clean, Annex 1: Strategic Action Plan on Road Safety, European Commission (May 17, 2018); *EU Road Safety Policy Framework 2021-2030 - Next steps towards "Vision Zero",* European Commission, Commission Staff Working Document (June 19, 2019), etc.

The second important aspect we have mention is the consideration of the previous CBA results, achieved in the field of eCall IVS, such as: *Europe (EU28) vs. Norway - Assessment of Socio-economic Impact of In-vehicle Emergency Call (eCall).* Norwegian University of Science and Technology (Brembo, June 2016); *Cost-benefit assesment and prioritisation of vehicle safety technologies. Final report*, European Commission Directorate General Energy and Transport (January 2006); *Impact Assessment*, Accompanying the document *Commission Recommendation on support for an EU-wide eCall service in electronic communication networks for the transmission of in-vehicle emergency calls based on 112* ('eCalls'), European Commission (September 8, 2011); *Preliminary impact assessment of implementation of eCall in Hungary*, eCall/HeERO (Lindenbach, December 12-13, 2013); *Impact assessment on the introduction of the eCall service in all new type-approved vehicles in Europe, including liability/legal issues*, Final Report, Issue 2, SMART 2008 Project Report (Lindenbach et al., September 13, 2013); *Accelerating C-ITS Mobility Innovation and deployment in Europe*, D2.1 Ex-ante Cost-Benefit Analysis, C-MobILE Consortium (Mitsakis and Kotsi, February 28, 2018); *Cost-effectiveness analysis of policy options for the mandatory implementation of different sets of vehicle safety measures, Review of the General Safety and Pedestrian Safety Regulations*, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, European Commission (Seidl et al., April 26, 2018), etc.

4. Total Acceptance Model applied for after-market eCall IVS

The decision-making problem of research appears against the backdrop of the need to improve traffic safety. In this context arises the need to assess adoption of the eCall device after-market project **SAFE 2018-EU-TM-0079-S** financed by the European Commission. The implications of using an eCall based on 112 devices are all the greater since the eCall after-market systems could have a considerable impact on reducing fatal accidents in Central and Eastern Europe (ETSC, 2019).

Thus**, there is a need of an in-depth investigation of the reasons why** some individuals adopt the use of eCall devices, while others reject them. The literature is rich in such motivational studies, **descriptive research**, meant to study the opinions and perceptions of individuals with regard to the main advantages but also barriers in adopting a technology (for example: Saprikis et al, 2010; Khare and Rakesh, 2011). A use eCall device is a behaviour that is not entirely volitional, it depends not only motivational factors. There are situations in which some individuals cannot buy and use the device because they do not know what it is used for, or they cannot afford to buy it or install it on the vehicle. In addition, not all consumers have the skills and knowledge needed to use it.

These inhibitory factors are brought together under the concept of perceived behavioral control within the TPB - Planned Behaviour Theory (Ajzen, 1985), which includes both the facilitating factors and the perceived personal effectiveness of the consumer. But the mere adoption of an innovation does not implicitly imply **continuity** (Rogers, 1995). The consumer can at any time give up the purchase of the eCall device, resulting in the **discontinuation of the** decision to use. Thus, a **second direction of study is** observed in the modelling of usage behaviour, namely the studies focused on the **post-adoption** phenomenon.

One of the most difficult tasks of the researcher is precisely to identify the fundamental beliefs of the individual, able to determine much of his attitude towards an object or towards a behaviour (Fishbein and Ajzen, 1975, p. 218). In order to choose those fundamental beliefs in determining the consumers' attitude towards the adoption of the eCall device, we used the Technology Acceptance Model (TAM) that identifies two fundamental beliefs of individuals: perceived usefulness and ease-of-use (Davis, 1989). Perceived usefulness, a concept of TAM, represents the user's conviction that the use of an information technology entails several benefits (Davis, 1989, p. 320). But consumers' beliefs about the usefulness of the eCall device are not only a determining factor in adoption (Said, 2011; Bosque and Crespo, 2011), but also a factor in the continuity of this behaviour. The main hypotheses, based on the original TAM, are shown in Figure 2. This sampling method was chosen due to the impossibility of using a sampling frame. The cases in which the sampling frame cannot be determined require the use of an improbable sampling method (Babbie, 2011, p. 206). One of the most used non-probability sampling methods is random sampling, which involves finding respondents in places where they can be found, places that are within the researcher's reach (Jackson, 2012, p. 102).

By determining **the sample size**, it was desired to comply with the requirements regarding the size, in order to make it possible to extrapolate the research results to the entire population surveyed. To this end, we started from the concept of "proportion" that describes the studied community, to determine the sample size in relation to the investigated attributes: **n** = the sample size; **t** = coefficient associated with the probability of guaranteeing the research results (confidence level); **p** = the percentage weight of the components of the sample that are characterized by a certain attribute; **q** = the percentage weight of the components of the sample that are not characterized by the attribute p, being determined as a relation (1 - p); **e** = margin of error.

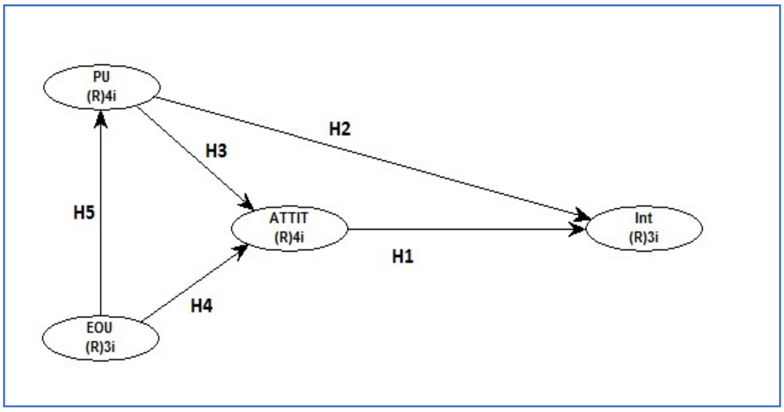

Figure 2: Model hypotheses

Source: Own assumptions, based on Davis, 1989, p. 320

Given that the sample will be used to investigate consumers' intention to use the eCall device, a "driving license" **attribute** was chosen as the **key attribute**. According to the **Eurostat** report **(2019), in the EU there is a** 294,966,256 **vehicles stock**. Based on these statistics, one can calculate the weight of the persons who would be targeted in purchasing the eCall device among the drivers, the current **population in the Eu** stands at roughly 513.481.690 (Eurostat, 2019). Based on these official data, the value of attribute "p" will be p= 0.575, and that of attribute q will be q=0.425. It was decided to work under a confidence interval of 0.05, corresponding to a probability of guaranteeing 99% results and a margin of error of +/- 5%. Thus, the sample size will be $n = 2.58^2 \times 0.575 \times 0.425 / 0.05^2 = 1.626/0.0025 = 650.66$

Based on the above considerations, the research sample must include no less than 651 observation units to respect the principle of representativeness for the investigated population. However, current results involve **model pretesting on 256 respondents,** therefor the present study does not feature a representative sample. A representative sample with updated model results will be available on the project website (https://safe112.eu/). The conceptual model of the study involves defining and determining the measurements of **4 latent variables**: the consumers' intention to buy the eCall device, the attitude towards the use of the device, the perceived usefulness, and the ease of use. The first step in determining the measurements of the latent variable "consumers' intention to continue use/buy eCall" is to define it at both general and specific levels. The complete profile of Internet users, who have a driver's licence and who have answered yes to the request to participate in the survey, is presented in Table 1. It can be noticed that there are no significant differences in the gender of the respondents, 45.42% being women and 54.57% being men. Very large differences appear within the demographic variable "age". Most of the respondents are between 16 and 30 years old: 41.21% are between 16 and 30, 30.33% between 31 and 40, 14.8% between 41 and 50, 10.59% are between the ages of 51 and 60, and 3.04% are over 60 years old.

Table 1: Respondent profile

Characteristics	Percentage (%)	Characteristics	Percentage (%)
Age		**Vehicle age**	
16 - 30	41.21	Less than 5	35.12
31 - 40	30.33	More than 5 but less than 10	32.36
41 - 50	14.8	More than 10 but less than 15	27.57
51 - 60	10.59	Over 15	4.93
Over 60	3.04	**Driving frequency**	
Prefer not to answer	0	Daily	57.91
Gender		Several times a week	13.64
Female	45.42	Several times a month or on weekends	13.64
Male	54.57	Occasionally (less than once a month)	6.82
Residence		**Drive area**	
Urban	80.11	In the city/village	76.77

Rural	19.88	Outside the city/village	22.35
Vehicle type		**Vehicle type**	
Car or taxi	87.22	HGV	1.59
Motorcycle	4.2	Bus or coach	5.51
Moped	0.72	Other	0.72
Lorrie	0		

Source: Survey Data

Regarding their place of residence, 80.11% of the respondents live in the urban environment, and 19.88 % live in rural areas. Most respondents, namely 80.11% reside in the city, only 19.88% declared to reside in the rural environment. Regarding their vehicle types, as expected, most respondents drive passenger vehicles (87.22%), described as cars or taxis. Also, 5.51% drive a bus or coach, followed by motorcycles at 4.2% and HGVs, at 1.59%. Respondents are more evenly distributed according to the age of their vehicles. Regarding vehicle age, most of the respondents, namely 35.12% of the total respondents declared that their vehicle is less than 5 years old, followed by less than 10-year-old vehicles (32.36 %) and more than 10 but less than 15 years old (27.57%). At the opposite pole are those who own vehicles that are over 15 years old (4.93%). With regards to driving frequency, most of the respondents 57.91% drive daily, followed by those who drive several times a week (21.62%). The main area of driving is in the city/village (76.77%), with only 22.35% declaring that they most often drive outside the city/village.

Model conformity testing

Before verifying the hypotheses based on the analysis of the path coefficients, it is necessary to validate the model by interpreting the model's compliance indicators (model fit indices). WarpPLS 3.0 generates three such compliance indicators: mean link coefficient (APC), mean square R (ARS) and mean variance of inflation factors (AVIF).

Table 2: Model fit and quality indices

Model fit indices	Eligibility criterion
Average path coefficient (APC)=0.427, P<0.001	P<0.05
Average R-squared (ARS)=0.470, P<0.001	P<0.05
Average adjusted R-squared (AARS)=0.466, P<0.001	P<0.05
Average full collinearity VIF (AFVIF)=2.265	acceptable if <= 5, ideally <= 3.3
Sympson's paradox ratio (SPR)=1.000	acceptable if >= 0.7, ideally = 1
R-squared contribution ratio (RSCR)=1.000	acceptable if >= 0.9, ideally = 1
Statistical suppression ratio (SSR)=1.000	>= 0.7

Source: SEM Output

Ned Kock recommends two criteria for testing the model's conformity: first of all, it is necessary that the P values associated with the average link coefficient and of the average square R be less than 0.05; second, it is necessary that the value of the average variance of inflation factors be less than 5 (Kock, 2012, p. 30). The study of path coefficients and the associated p-values allows validation or rejection of hypotheses. We can see that all hypotheses are verified at a significance threshold of 0.001. Thus, it can be stated that most respondents believe that they have the skills and knowledge to use eCall based on 112 IVS. Also, the direct and positive impact of the attitude on consumers' intention to buy eCall based on 112 IVS is validated.

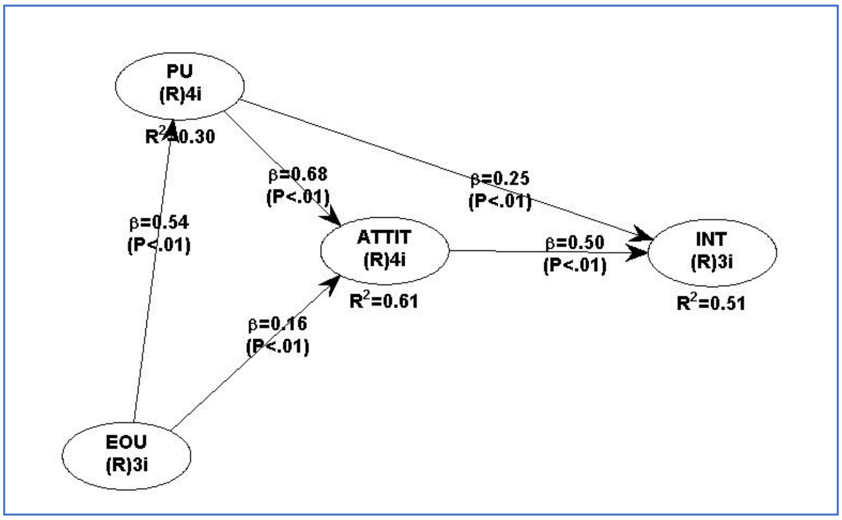

Figure 3: Model results

Source: Model estimates

5. sAFE project for eCall – Cost Benefit Analysis

The need justification for reaching Cost Benefit Analysis (CBA) for after-market eCall based on 112 is based on the following arguments (Schulz and Scheler, 2018, p. 2): the eCall system is a technology designed to help increase road safety, which holds a central position in the EU Road Worthiness Package 2020 (published in May 2017, which also includes specific provisions for the development and consolidation of EU-wide interoperable eCall); the economic analysis for carrying out the installation action of the eCall after-market device is necessary, as this investment will contribute to the implementation and extension of the provisions contained in Article 18 a of Directive 2014/45/EU (April 3 2014), according to which: *vehicles used on public roads are required to be roadworthy when they are used; the holder of the registration certificate and, where applicable, the operator of the vehicle should be responsible for keeping the vehicle in a roadworthy condition*; the results of the analysis must provide reliable information on the opportunity to install the eCall based on 112 devices on all vehicles driving on European roads, regardless of their age or category.

Therefore, we note that a key measure for increasing rescue chain performance, in the event of serious accident interventions, is the large-scale installation of eCall IVS devices (Kaltenegger, Salamon, and Furian, 2018, pp. 4-5). This fact is already specified in the framework documents for regulating road traffic in the EU, in terms of improving traffic safety, such as: Regulation 2015/758/EU, regarding the mandatory installation of the device in new M1 and N1 type vehicles, starting with April 2018; Decision 585/2014/EU, with reference to the deployment of the interoperable EU-wide eCall service; Regulation 305/2013/EU, formulated on the basis of the ITS directives regarding the specifications required for the modernization of the PSAPs infrastructure, in order to improve their ability to handle eCall type calls - the receipt and the handling of eCalls; Regulation 2017/78/EU, regarding the protection of personal information; Regulation 2017/79/EU, which is destined for the elaboration and realization of the technical specifications of the eCall device and of the procedures for testing its viability.

An extremely important aspect is that, in accordance with the provisions of the Regulation on the approval of the device, the European Commission will have to submit, on March 31, 2021, a complete report on the achievements in the field, the penetration rate of the eCall device and the opportunity of installing the device and extending the regulation to other types of vehicles (other than M1 - passenger cars and N1 - light trucks). For ECBA results to be relevant and useful to decision makers (EU regulatory bodies, national authorities, vehicle manufacturers and users etc.), we will choose the seven-step model, recommended and applied by EC through DGET, which will be adapted and supplemented both with the best practices identified in other cost-benefit analyzes conducted for this technology, and with the provisions of the EU regulations in the field, which are currently applied.

The developed ECBA stages were: defining accidents relevant to the eCall technology based on 112; defining the concept of eCall technology; the scenarios for implementation; assessing the impact of eCall technology on the number of fatalities and severe injuries; identification and monetary evaluation of benefits; identification and monetary evaluation of costs; economic cost benefit assessment. In order to quantify the cumulative value of the benefits in the three scenarios, regarding the impact of eCall IVS on road fatalities and severe injuries, the following scenarios were considered:

- In the Do-nothing scenario (DNS), the annual impact on fatalities reduction to severe injury will be 3.7%, and the annual impact on severe injuries reduction to slight injury will be 5.5% (installing the eCall device is for a maximum of 10% of total EU28 passenger vehicles);
- In the Do-minimum scenario (DMS), the annual impact on fatalities reduction to severe injury will be 5%, and the annual impact on severe injuries reduction to slight injury will be 6.5% (installing the eCall device is for almost 30% of total EU28 passenger vehicles);
- In the Do-something scenario (DSS), the annual impact on fatalities reduction to severe injury will be 9%, and the annual impact on severe injuries reduction to slight injury will be 9.5% (installing the eCall device is for around 95% of total EU28 passenger vehicles).

For calculating the discounted values of the total annual costs, for the three scenarios, we used their current values, calculated for a unit price of 150 Euro, respectively 100 Euro. After calculating the discounted value of the annual benefits and costs, for each scenario option were calculated:

- Benefit-Cost Ratio *BCR = (Total discounted benfits / Total discounted costs) X 100* [%].
- Net Present Value *NPV = Total discounted benfits – Total discounted costs*.

Following the BCR calculation for a unit cost of 150 €/unit (equal with the unit price, according to previous assumptions), we note that the only scenario for which the indicator value is greater than one (1.6) is DNS. Therefore, for the other two scenarios, at this level of annual costs, it is not appropriate to install the eCall after-market, at the level of the entire fleet of EU28 passenger vehicles, neither in the DMS nor in the DSS version.

In contrast, if we calculate BCR for a unit cost of 100 €/unit, we notice that we have two scenarios for which the result is at least equal to 1. In the DNS scenario, BCR is greater than 3 in the first eight years of forecast and equal with 3 in 2028 and 2029. But, considering that the unit price may decrease as the number of installed units increases, we can see that this scenario is very good. Regarding DMS, the value of BCR is greater than one in the first six years and equals 1 in the rest of the period.

Table 3: NPV (Mill. €) and BCR, 2020-2029

150€/unit				
Scenario	**Total cumulated benefits**	**Total cumulated costs**	**NPV**	**BCR**
DNS	6.020	3.450	2.570	1,75
DMS	7.419	10.301	-2.882	0,72
DSS	11.741	32.569	-20.828	0,36
150€/unit				
Scenario	**Total cumulated benefits**	**Total cumulated costs**	**NPV**	**BCR**
DNS	6.020	2.308	3.712	2,6
DMS	7.419	6.876	543	1,1
DSS	11.741	21.939	-10.198	0,5
50€/unit				
Scenario	**Total cumulated benefits**	**Total cumulated costs**	**NPV**	**BCR**
DSS	11.741	10.872	869	1,1

Source: Own calculations

So, if the installation would be done at a cost less than 100 €/unit in the first interval (2020-2025), respectively at a lower value in the second interval (2026-2029), we can consider that this scenario is also appropriate. In contrast, in the third scenario (DSS), we observe that for a unit cost of 100 €/unit only a maximum of 50% of the efforts are covered (in the period 2024-2029), so this version is not appropriate. Instead, for a unit cost of 50 Euro, the third scenario can be considered, with good chances of success.

6. Conclusions

We tested the 5 main hypotheses of the study by **analysing the path coefficients** within the structural model, but not before testing the conformity of the model by studying specific indicators. Based on the **obtained compliance indices**, **APC = 0.427 (P <0.001), ARS = 0.470 (P <0.001) and AVIF = 1.929**, we can affirm the conformity of the **model, which has a good predictive and explanatory capacity**.

To confirm the primary hypotheses of the research, we resorted to structural equation modelling (SEM), based on the analysis of variance: PLS - partial least squares. Through the analysis of the path coefficients (standardized β coefficients), **we were able to validate all the causal relationships of the initially proposed conceptual model**, and the path coefficients were significant at a chosen significance threshold of p <0.01.

The analysis of the path coefficients was extremely useful in validating the primary hypotheses of the research, but they only considered the direct effect of the exogenous variables on the endogenous variables. Due to the complexity of the model and given the existence of variables with mediating effect, it is necessary to include the study of indirect effects. Thus, the existence of indirect effects on the consumers' intention to buy / use eCall IVS with statistically significant effects will be further observed. For example, the existence of fundamental consumer beliefs that directly and indirectly influence behavioral intention (this is the case of consumer beliefs about the eCall IVS usefulness, which not only directly influences the behavioral intention, but also indirectly.

In order to have a clearer picture on the complexity of the ECBA achieved, we consider that it is necessary to briefly review the main results obtained: analysis of statistics from various databases relevant to the EU, with reference to the evolution of the passenger vehicle fleet in EU28, the number of accidents relevant to the CBA, the effects of severe accidents; forecasting the evolution of the number of passenger vehicles 2020-2029, using a well-grounded methodology, having the calculation of the Increasing Indexes of renewal rates for this category of vehicles as reference (using the latest statistics published by Eurostat); identification and evaluation in monetary terms of the benefits generated by the installation of the eCall device, and the costs incurred by the implementation of the project, by cost categories, for each scenario; valuation of the economic efficiency of the project, by calculating BCR and NPV for the 10-year forecast horizon and analysing the evolution of its annual value, for three versions of unit cost (equal with unit price), respectively 150, 100, and 50 €/unit.

However, the purpose of the decision-makers in the field of road traffic safety in the EU is to reduce the severity of the effects of road accidents, by installing the eCall device aboard passenger vehicles traveling on European roads. For this purpose, the DSS scenario version is optimal. We note that, with the unit cost reduction, the situation for DSS is becoming more and more optimistic.

In the previously considered version, we notice that for a unit cost of 50 €/unit BCR becomes greater than one over the entire forecast range. This results in a very simple aspect. The lower the unit costs, the higher the BCR value. We recall that in this analysis we only considered the savings achieved by reducing Human costs (meaning only 88.82% of the total unit costs of fatalities, and severe injuries), without taking into account the cost elements in the Production loss, Medical costs and Administrative costs categories.

In fact, the benefits of installing the eCall device are much greater, than the elements considered so far, to maintain a prudent level of analysis (as is normal when evaluating a project as complex as the one addressed in this paper). Future research will cover the TAM confirmation on a representative sample and the possibility to extend recommendation for other vehicle types registered in the EU.

7. Acknowledgements

The research described in this paper was supported by the ***sAFE - Aftermarket eCall For Europe*** project, that is funded under the Connected Europe Fund Annual Programme, Grant agreement Number 2018-EU-TM-0079-S, which aims to define the standards and specifications to pave the way for deployment of after-market systems for eCall.

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