RESOLVE

RANGE OF ELECTRIC SOLUTIONS FOR L CATEGORY VEHICLES

D7.3 – Exploitation and Dissemination Report

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Authors	Riccardo Giannetti	UNIPI
	Riccardo Lanzara	UNIPI
	Andrea Dello Sbarba	UNIPI
	Federico Castaldi Cuppari	UNIPI
	Serena Fruttaldo	RELAB
	Marco Pieve	PIAGGIO

Consortium:

PIAGGIO & C. SPA, AUSTRIAN INSTITUTE OF TECHNOLOGY GMBH, ROBERT BOSCH GMBH, CESKE VYSOKE UCENI TECHNICKE V PRAZE, IDIADA AUTOMOTIVE TECHNOLOGY SA, KISKA GMBH, KTM AG, MAGNETI MARELLI S.P.A., RE:LAB S.R.L., RICARDO DEUTSCHLAND GMBH, UNIVERSITÀ DEGLI STUDI DI FIRENZE, UNIVERSITÀ DI PISA, WAMTECHNIK SPOLKA Z OGRANICZONA ODPOWIEDZIALNOSCIA, THE UNIVERSITY OF WARWICK

Summary

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Revision history

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Abbreviations list

BM	Business Model
BMS	Battery Management System
D1	Vehicle Demonstrator 1
D2	Vehicle Demonstrator 2
D3	Vehicle Demonstrator 3
ELV	Electric L-category Vehicle
EU	European Union
GV	Green Vehicles
HMI	Human Machine Interface
KIBS	Knowledge Intensive Business Service
ICE	Internal Combustion Engine
LV	L-category Vehicle
RPM	Revolutions Per Minute
SOC	State of Charge
SOH	State of Health
TCO	Total Cost of Ownership

Glossary

L-category Vehicle (LV) – Any two-three and four wheeled vehicle classified according with regulation 168/2013 Annex I.

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List of figures

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Executive Summary

D7.3 Exploitation and Dissemination report is the final document that summarizes Dissemination, Communication and Exploitation carried out in the Project RESOLVE.

In particular, it refers to activities carried out in T7.1 Communication plan and T7.2 Exploitation plan.

D7.1 Communication Plan (including communication guidelines) and D7.2 Exploitation Plan were delivered at the beginning of the project (M3 and M9, respectively): they were aimed at planning activities and tools to spread project results, create awareness about project achievements, enable their valorization and re-use even after the project end.

At the end of the project (M36) the delivery of D7.3 can be seen as the sharing of experiences, knowledge, expertise achieved during RESOLVE involving multiple, targeted audiences, with the objective to transform and capitalize these achievements into valuable content for the debate about making ELVs a viable alternative to ICE vehicles.

D7.3 is made of two main parts.

The **first part** is dealing with **Dissemination and Communication** activities of RESOLVE project, carried on to reach the goal to create awareness about the project and its results, by spreading and promoting them to partners and stakeholders.

Dissemination and Communication activities were always considered of primary importance for the RESOLVE consortium since only if the achieved project's results are widely communicated to the public the impact of the project can be meaningful.

The Dissemination and Communication activities of the project were carefully selected and planned since its beginning – mainly within T7.1 Communication Plan - in order to maximise the efficiency of the resources employed to this scope.

The planning was made through the "Communication Plan" document (deliverable D7.1) which was issued at the beginning of the project (M3).

The **second part** of this deliverable summarizes **Exploitation** of project deliverables by OEMs and other industry partners, as well as by Knowledge Intensive Business Services organizations (KIBS) involved in the project.

Particularly, market analysis aims at identifying possible business models to be adopted for wide spreading RESOLVE's vehicle concept. Results deriving from market analysis and cost reduction in initiative represent a premise for OEMs and industry partners exploitation plans.

On the other hand, RESOLVE project has been able of contributing to the development of new knowledge within KIBS organizations involved in the project in terms of strategic learning developed through educational activities (for Universities), research and consulting activities (for all KIBS organizations involved). Furthermore, both Universities and other KIBS, share acquired knowledge and create new relationships with organizations of different sectors, municipalities, scientific community and public media.

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Document structure

D7.3 is structured into two main parts:

- the general Dissemination and Communication strategy, in which also activities and tools are identified, in relationship with impacts RESOLVE aimed to address;
- the exploitation of RESOLVE results by OEMs and other industry partners, as well as by Knowledge Intensive Business Services organizations (KIBS) involved in the project;

The Objectives, Goals and respective activities reported in the deliverable can be summarised as follows and can be linked to specific chapters of this document:

OBJECTIVES	CHAPTERS IN THIS DELIVERABLE
Plan activities in order to optimize resources while achieving objectives effectively	**Chapter 1, Communication & Dissemination Strategy**
Continuously update the RESOLVE dissemination and communication material	**Chapter 2, Communication & Dissemination Tools and Material**
Identify key events where knowledge, experiences, results, achievements in general, gained within RESOLVE, can be shared in order to get wide awareness on the project and its results; Publish key results (respecting the confidentiality limits) through well-known publications, events and conferences.	**Chapter 3, Events and publications**
Present key concepts, solutions and results to all Stakeholders in order to achieve a wide awareness on the project and to discuss next steps and implementation issues; Be active on local and National events to present the RESOLVE work to a wider audience and in different languages; Cooperate and strengthen relations and synergies with other GV-related projects so that the experiences, results, achievements in general, gained within RESOLVE, can be utilized by other organizations and individuals interested in such an area.	**Chapter 4, Liaison Activities**
Over the project life, several means to present RESOLVE and its results have been identified: since the time of proposal writing, quantitative criteria have been set, in order to assessment of the Dissemination and Communication activities through quantitative criteria including scientific publications, conferences, direct private conversations website visits, trade shows, press releases and reach-through communications.	**Chapter 5, Assessment**
Present key concepts and solutions concerning OEMs market analysis, D1 and D2 demonstrator market opportunities and cost reduction initiatives such as functional integration, modularity, scalability and application of state-of-the art low-cost solutions already existing in automotive field suitable for L-category vehicles, in order to describe how OEMs and industry partners can exploit Resolve project outcomes	**Chapter 6, Exploitation of research deliverables by OEMs and other industry partners**
Identify how knowledge intensive business services (KIBS) organizations exploited and will exploit project outcomes through strategic learning, knowledge creation/accession/use and improvement in relational capital	**Chapter 7, Exploitation of project deliverables by Knowledge Intensive Business Services organizations (KIBS)**

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1. Communication & Dissemination Strategy

Dissemination and communication activities carried out in the project have had the common objective of reaching primary and secondary stakeholders to maximize the impact of the project (consistent with the expected impacts defined in the call) and foster the exploitation of the results. The dissemination has mainly focused on spreading the results achieved during the project, while the aim of the communication has been to enhance the public engagement and create market expectations for ELVs as an alternative to ICE cars for urban mobility.

With respect to this scope (ELVs as an alternative to ICE cars for urban mobility), barriers and limiting factors ELV widespread adoption have been identified, as well as impacts RESOLVE aimed to have in different areas.

This has led to identify project objectives that allowed to deal with such impacts (Figure 1).

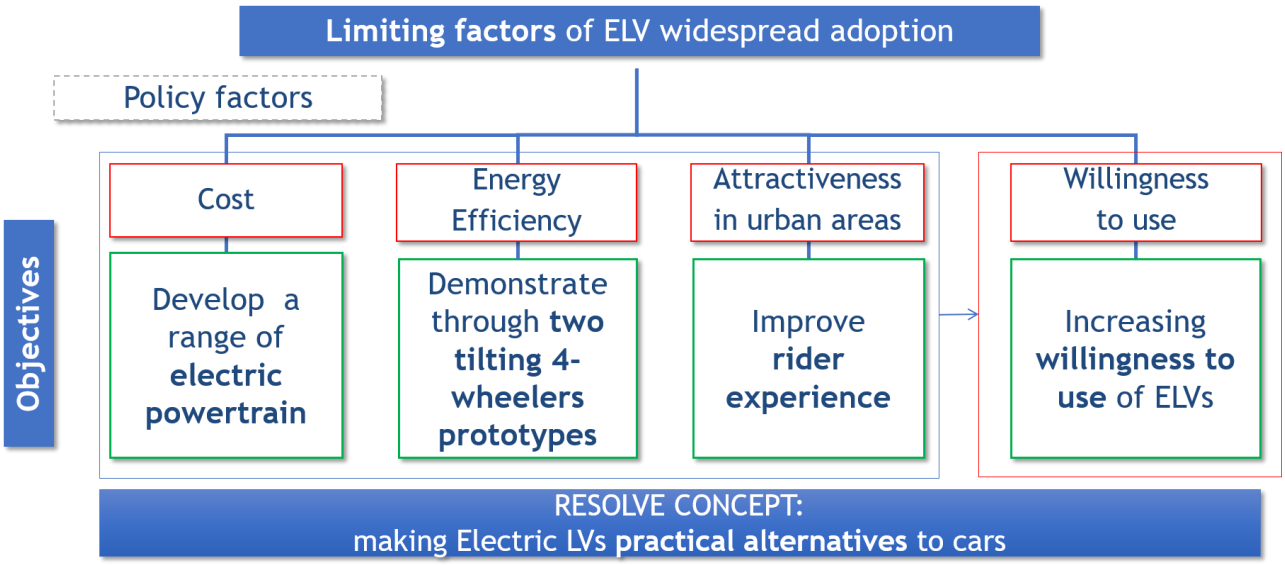

Figure 1 – Barriers, to ELVs adoption, impacts and objectives

1.1. Target groups

Once project impact and objectives have been identified, and the project activities progressed towards reaching them, impacts identified for RESOLVE have been put into relationship with target groups defined in D7.1, in order to maximize potentialities of Dissemination and Communication tools and activities in spreading project results and foster their uptake (Table 1).

Table 1 - Target groups

IMPACT	TARGET GROUP	TOOLS
Reduce: • energy consumptions • price of the vehicle • maintenance cost • journey time and traffic congestion • operational costs Improve riding experience	End-user enthusiasts	Project web site, social network posts, promotional events, press articles, videos, newsletter campaigns, articles, press releases, seminars, reach-through communications

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IMPACT	TARGET GROUP	TOOLS
Increase energy efficiency	Scientific/R&D community	Scientific publications, deliverables sharing, conferences, events
Reduce cost of production	Other L-category manufacturers	Conferences, trade shows, events (especially involving manufacturers e.g. ACEM conference, Ricardo), newsletter campaigns
Reduce local and global emissions	Policy makers	Conferences and events involving policy makers (e.g. TRA conference, EGVI), newsletter campaigns
Introduce solutions applicable to a range of electric vehicles	ELV supply chain	Contacts with a number of industry associations (including ACEM), bilateral contacts with other collaborative research initiatives in fields relevant to RESOLVE, newsletter campaigns
All of the above	Internal communication of project results and knowhow within the partner organizations	Project repository, project website, email, deliverables, publications

The success of the dissemination and communication process has been evaluated through an iterative process to continuously tailor it, according to the ongoing feedback received by the target users.

1.2. General strategy

Dissemination, communication, networking and awareness-raising are critical to ensure the success of the project and a real impact towards its targets groups. Therefore, since the project beginning it has been deemed essential to plan efficient and timely activities focused on these aspects, in parallel to the core activities of the project. To this scope, D7.1 Communication Plan has been delivered at M3.

All partners have been involved in Dissemination, Communication and Exploitation activities throughout the entire life cycle of the project: they were required to contribute with their networks and experience in EC funded projects as well as to have a close monitoring of their implementation.

Over the course of the project, the RESOLVE consortium has been spreading the results of the project to multiple audiences, via different channels, at different moments. This has been necessary throughout the project for the purposes of raising awareness and inviting debate on the scientific and technical work which has been undertaken and issues addressed; as well as for the dissemination of the projects deliverables and results to promote uptake and increase impact of the project.

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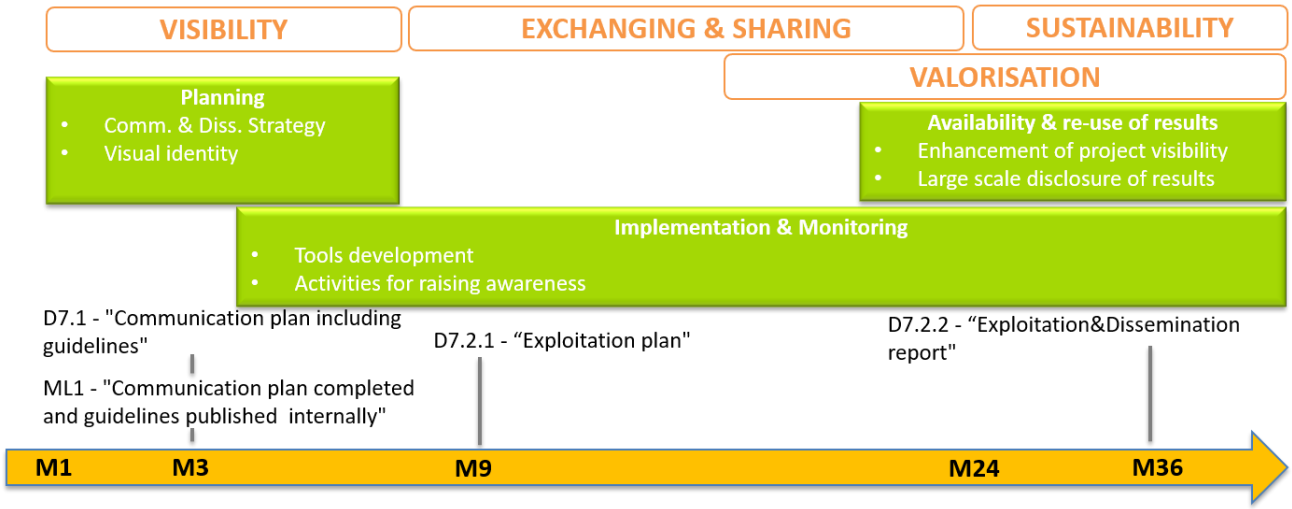

Figure 2 - Dissemination, Communication, Exploitation strategy

Dissemination, Communication and Exploitation activities have been carried out all over the project life and have changed accordingly, being crucial for the achievement of project objectives and the promotion of the visibility and stakeholders' awareness, as well as to ensure valorization and extensive use and impact of the RESOLVE results (Figure 2).

2. Communication & Dissemination tools and materials

The main aims of the RESOLVE communication and dissemination strategy are to maximize the impact of the research and development actions through communication and to define the specific contents and forms of communication and dissemination material of the project, taking into account the different target groups and their specific background in terms of knowledge, context, motivation and potential uptake of various media.

Based on this, the specific communication and dissemination objectives have been identified as follows:

- to raise awareness, disseminate and promote the project's activities and results, with online and off-line tools, networking, events and media and press work. This specific objective is strengthened by a strong collaboration and coordination with all the different work packages and in particular with T7.2 (Exploitation);
- to achieve high visibility within the scientific community and with political actors at various levels to support a wide deployment of results;
- to share knowledge, lessons learned and strategies in order to support its transfer to stakeholders in order to lower barriers to the adoption of electric mobility in particular in urban context.

Consequently, during the project the focus has been on a combination of continuous dissemination, communication and exploitation actions, also in collaboration with relevant stakeholders, to exchange knowledge and practices that help attract ICE car drivers to switch to ELVs for daily urban commutes.

Figure 3 shows how actions and tools developed in RESOLVE to spread information, disclose results, share results and promote their re-use, have been clustered into dissemination, communication and exploitation actions.

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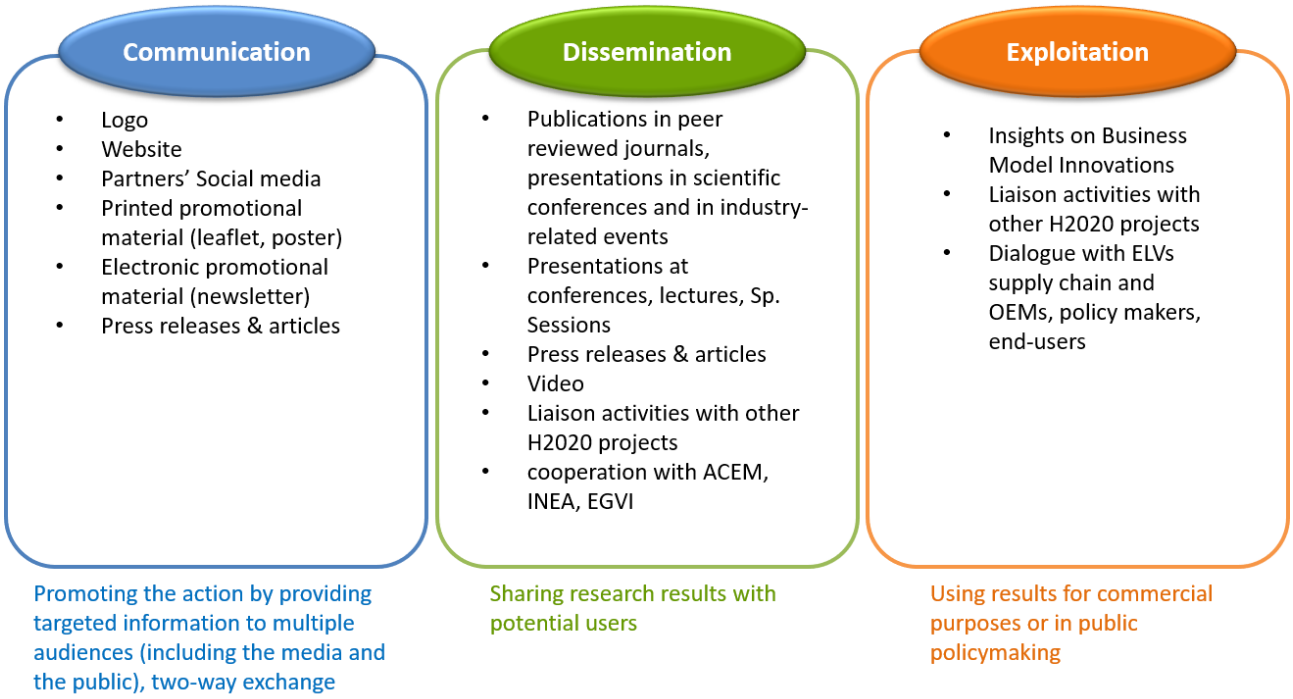

Figure 3 - Activities and tools under Dissemination, Communication and Exploitation

The ratio behind this clustering is to identify actions that best suits the different scopes which dissemination, communication and exploitation are devoted to: all of them concur to the ultimate scope to build up knowledge and practices that and promote a dialogue with the whole community to overcome barriers to a widespread of electric mobility.

Communication - Promoting action and information

Electronic and online tools have been developed in order to enable the project to promote the action itself and its results to a multitude of audiences, including the media and the public. It was conceived as a two-way exchange, fostering the debate around RESOLVE issues.

Dissemination - Public disclosure of the results of the project in any medium.

The process of promotion and awareness-raising started form the very beginning of the project and has been planned and organized in D7.1 - Communication plan.

It aimed to make research results known to various stakeholder groups in a targeted way, to enable them to use the results in their own work.

Exploitation - Use of the results during and after the project's implementation.

It can be for commercial purposes but also for improving policies, and for tackling economic and societal problems.

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2.1. Overview of tools and materials

Logo

At the very beginning of the project, a logo has been created to make RESOLVE visible and recognizable.

Main colors used have been green – which reminds green mobility – and blue – to highlight that RESOLVE is a European project: this is remarked also by the EU flag on the V letter.

The plug represents the electric vehicle. The V letter also compose a rider.

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Figure 4 - Project logo

Website

Since the first months of project lifecycle, RESOLVE has established an online presence both with its own website and within relevant social networks via project partners' account.

The project website (http://www.resolve-project.eu/ - Figure 5) has been created and published at the beginning of the project; then it has undergone some changes in order to improve its look&feel; then it has been considerably re-styled in order to make it more appealing and more functional.

The website content has been updated all over the project life.

Figure 5 - RESOLVE website - Section of the Homepage

Newsletter

An online project newsletter has been periodically distributed to a contact list including project partners, contacts and people who have subscribed via the project website and contacts collected during the final event.

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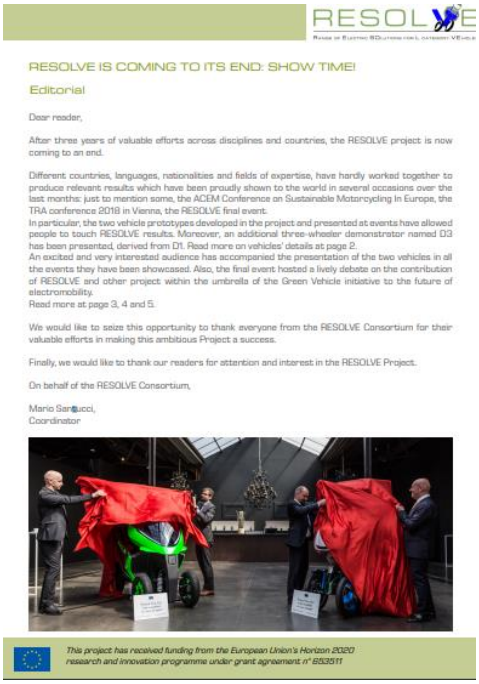

RESOLVE IS COMING TO ITS END: SHOW TIME!

Editorial

Dear reader,

After three years of valuable efforts across disciplines and countries, the RESOLVE project is now coming to an end.

Different countries, languages, nationalities and fields of expertise, have hardly worked together to produce relevant results which have been proudly shown to the world in several occasions over the last months: just to mention some, the ACEM Conference on Sustainable Motorcycling in Europe, the TRA conference 2018 in Vienna, the RESOLVE final event.
In particular, the two vehicle prototypes developed in the project and presented at events have allowed people to touch RESOLVE results. Moreover, an additional three-wheeler demonstrator named D3 has been presented, derived from D1. Read more on vehicles' details at page 2.
An excited and very interested audience has accompanied the presentation of the two vehicles in all the events they have been showcased. Also, the final event hosted a lively debate on the contribution of RESOLVE and other project within the umbrella of the Green Vehicle initiative to the future of electromobility.
Read more at page 3, 4 and 5.

We would like to seize this opportunity to thank everyone from the RESOLVE Consortium for their valuable efforts in making this ambitious Project a success.

Finally, we would like to thank our readers for attention and interest in the RESOLVE Project.

On behalf of the RESOLVE Consortium,

Mario Santucci,
Coordinator

Figure 6 - Editorial of the 5th issue of the newsletter

Five issues have been distributed, dealing with the following topics:

- 1st issue - December 2015 - RESOLVE: a step forward in European research on electric mobility
  - Presentation of the project
  - Interview with the Project Coordinator

- 2nd issue – July 2016
  - User survey about general aspects of electric L–vehicles and the specific HMI topic
  - Exploitation of project results

- 3rd issue – January 2017 – Halfway!
  - Tools & knowledge for demonstrators design
  - Early technical results

- 4th issue – July 2017 - Innovation in RESOLVE
  - Use of state of art low-cost solutions
  - Scalability and functional integration: DMM - Drivetrain Management Module
  - Modularity and scalability of Battery Pack
  - Improving riding experience: HMI

- 5th issue - April 2018 - RESOLVE is coming to its end: show time!
  - Relevant results presented at important events such as the ACEM Conference on Sustainable Motorcycling in Europe, the TRA conference 2018 in Vienna, the RESOLVE final event.

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Video

At the beginning of the project a provisional video was released, with core project info and first images and sketches of the prototypes and of the HMI.

In occasion of the ACEM conference 2018 the video has been updated with images of D1 and D2.

For the final event the video has undergone final updates and included images of D1, D2 and D3. It is available on the project website, on the Home Page.

Leaflet, posters, flags

Leaflet and general posters have been created at the beginning of the project and updated during the project life.

Figure 7 - Leaflet and general poster

General posters have been updated for the ACEM conference 2018.

In occasion of the project final event technical roll up posters have been created to present achievements in the different project areas.

For the final event also two flags have been created and placed out of the premises to guide participants to the entrance.

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Dissemination kit

A dissemination kit was created for the project Final Event and distributed to all participants. It included a shopper, a folder, a note pad, an agenda of the event, a pen, an usb stick and a badge with a lanyard. It was customized with RESOLVE logo and graphics.

Figure 8 - Dissemination kit

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3. Events and publications

The following events, initiatives, activities and publications have been identified as opportunities to present RESOLVE and increase its visibility and awareness about its results:

Table 2 - events and publications

EVENT	TYPE OF PRESENTATION	PARTNER RESPONSIBLE/AUTHORS	DATE	PLACE
44° Convegno Nazionale AIAS	Analisi di stabilità di veicoli basculanti a tre ruote	UniPI	28 July 2015	Messina
Master thesis	Sviluppo di modelli matematici per l'analisi dinamica di veicoli basculanti a 2 o più ruote.	UniPI Autore: Francesco Cerù. Relatori: F. Frendo, F. Bucchi, M. Guiggiani, O. Di Tanna	2015	
Master thesis	Analisi Multibody di Veicoli Basculanti a 4 Ruote	UniPI Autore: A. Campani Relatori: F.Frendo, F. Bucchi, O Di Tanna.	2015	
EMENDER 2015 Conference	Far far away: driving HMI requirements towards the comfortable range in Electric Vehicles	UniFI - RE:Lab	6 October 2015	Ljubljana, Slovenia
Master thesis	Studio di fattibilità di telaio leggero per veicolo elettrico basculante a quattro ruote	UniPI Author: L. Massicci Tutor: F. Bucchi, F. Frendo		

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EVENT	TYPE OF PRESENTATION	PARTNER RESPONSIBLE/AUTHORS	DATE	PLACE
MAR 2016 - MANUFACTURING ACCOUNTING RESEARCH CONFERENCE	• Presentation of the paper: Managing cost drivers: the case of RESOLVE project. Authors: Giannetti R., Risso L., Lanzara R. • Dissemination of models and scientific results presented at the Conference in 1) Cost Management PhD courses and 2) Master Degree courses)	UniPI Giannetti Riccardo, Risso Laura, Lanzara Riccardo - UNIPI (DEM)	15-17 June 2016	Lisbon, Portugal
European Conference on Hu man Centered Design for ITS	Understanding the User Needs in the Electric Mobility System: a Survey Study	UniFI, RELAB	30 June & 1st July 2016	Loughborough, UK
11th European ITS Congress 2016	Challenges and opportunities in the HMI design for EV	RE:Lab	6-9 June 2016	Glasgow, UK
TRA conference 2016	• The European Green Vehicles Initiative Association set up a stand at TRA 2016 EGVI displayed a slideshow for the entire duration of the TRA Conference to show the project it supports • Presentation of the paper 2Electric L-category vehicles for smart urban mobility, M. D. Santucci, M. Pieve (PIAGGIO & C. SPA), M. Pierini (Uni Florence) -- Oral presentation of RESOLVE in Session TWE1: Electric Vehicles Development	Piaggio	18-21 April 2016	Warsaw, Poland

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EVENT	TYPE OF PRESENTATION	PARTNER RESPONSIBLE/AUTHORS	DATE	PLACE
	• The European Green Vehicles Initiative Association set up a stand at TRA 2016 - EGVI displayed a slideshow for the entire duration of the TRA Conference to show the project it supports			
ACEM conference 2016	Presentation on RESOLVE	Piaggio	7 September 2016	Brussels, Belgium
AMAA conference 2016	KTM: speech on "The RESOLVE Project - An overview" within the Invited Session: Disruptive Approaches to Urban Electric Mobility	KTM	22-23 September 2016	Berlin, Germany
IFZ International Motorcycle Conference	Design of novel tilting electric four-wheelers.	UniPI, Piaggio, KTM F. Bucchi, F. Frendo, D. Simic, O. Di Tanna, M. Perterer	3-4 October 2016	Cologne, Germany
Article in journal	Modelling and Simulations of a Narrow Track Tilting Vehicle	JJ Chong, James Marco, David Greenwood	31 October 2016	Exchanges: the Warwick Research Journal
Master thesis	Analisi multibody di un veicolo basculante a 4 ruote innovativo	Author: Vestri Tutor: L. Bertini, F. Bucchi, F. Frendo, O. Di Tanna	2017	
Master thesis	Progettazione di componenti strutturali per veicolo innovativo a trazione elettrica	UniPI Author: A. Bellugi Tutor: L. Bertini, F. Bucchi, F. Frendo, O. Di Tanna	2017	

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EVENT	TYPE OF PRESENTATION	PARTNER RESPONSIBLE/AUTHORS	DATE	PLACE
Book	Bezpečnostní aspekty návrhu dopravních prostředků (book about safety aspects of vehicle's design)	KOVANDA, Jan et al.		
EATC 2017 9th European Altair Technology Conference	Presentation on "Simplifying a full vehicle model for FE analysis"	AIT - Authors: Stefan Scheiblhofer, Matthias Hartmann	26-28 June 2017	Frankenthal
Workshop organized by EU projects Esprit and Weevil "The transition to light electric vehicle: an opportunity to disrupt urban mobility?"	RESOLVE joined the debate on how light electric vehicles can contribute to sustainable mobility, together with other projects funded within the H2020 Green Vehicle call: Jospel, Esprit, Weevil: Piaggio has given a presentation on RESOLVE, RELAB has given support in liaison with event organizers and in poster sessions.	Piaggio/RELAB	July 4 2017	Reggio Emilia
2nd Italian-German Workshop on Motorcycle Research	Presentation of the activities carried out in RESOLVE by UniPI	UniPI	5-6 July 2017	Darmstadt
AIAS Conference 2017	Paper submission and presentation at on the multibody model of tilting four wheeler developed in the RESOLVE project;	UniPI	6-8 September 2017	Pisa
Global Conference on Services Management	Paper on Managing costs through business model servitization: a strategic management accounting perspective on the RESOLVE project	UniPI – Authors: Giannetti Riccardo, Dello Sbarba Andrea, Lanzara Riccardo, Yacoub Basheer	3-7 October, 2017	Volterra, Italy
MSC Vehicle Dynamics Conference 2017	Presentation on the multibody model of tilting four wheeler developed in the RESOLVE project by UniPI	UniPI	18-19 October 2017	Turin
IV european electric vehicle congress	KTM represented RESOLVE in a Round table of EU projects on EV	KTM	26-27 October 2017	Madrid

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Ricardo Motorcycle Conference	Presentation by Ricardo	Ricardo	5 November 2017	Milan
1ST LIGHT ELECTRIC VEHICLE SUMMIT	Ricardo: lecture on "RESOLVE - new vehicle architecture for urban mobility"	Ricardo	22-23 November 2017	Rotterdam, Netherlands
EGVIA -ERTRAC 1st European Conference Results	Presentation by the Coordinator	Piaggio	29-30 November2017	Bruxelles
ACEM conference 2018	Exhibition of Vehicle Demonstrators	Piaggio/KTM, RELAB	24 January 2018	Bruxelles
TRA conference 2018	Prototypes have been showcased in an area dedicated to RESOLVE in the European Commission booth; A live and interactive 10-minute project presentation has been given in the Media/Outreach area; Project video has been displayed in the Media/Outreach area; A curious and interested audience has lively interacted with RESOLVE partners who have presented the project.	Piaggio/KTM	16-19 April 2018	Vienna
RESOLVE Final Event	Presentation of project results Liaison with GV projects	All partners	25-apr-18	Bruxelles
The future of transport conference	Presentation of project results by Kiska	Kiska	19 - 20 June 2018	Cologne, Germany
A paper related to RESOLVE was published on an international journal	Stability analysis of a novel four-wheeled motorcycle in straight running. Meccanica, 52(11-12), 2603-2613.	Unipi - I: Bucchi, F., Cerù, F., & Frendo, F. (2017)	27 February 2017	https://link.springer.com/article/10.1007%2Fs11012-017-0645-x
General Assembly of the Humanist VCE	Presentation on WP5 by RE:Lab	RELAB	29-30 November 2017	Copenhagen

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EVENT	TYPE OF PRESENTATION	PARTNER RESPONSIBLE/AUTHORS	DATE	PLACE
Seminar on «HORIZON 2020: research and innovation in Public Administration»	Presentation on RESOLVE HMI by RE:Lab	RELAB	13 -14 December 2017	Collegio Europeo di Parma
"Come 3 nuvole" conference	Presentation on RESOLVE HMI by RE:Lab	RELAB	9 March 2018	Bologna
CoDIT'18 conference	Paper on Nonlinearity Compensation based Tilting Controller for Electric Narrow Tilting Vehicles	Warwick Authors: Yaxing Ren, Truong Quang Dinh, James Marco, and David Greenwood	10-13 April 2018	Thessaloniki
SIlverstream final event within ECAS conference	Presentation on RESOLVE with focus on HMI	RELAB	4-5 July 2018	Turin
AEIT AUTOMOTIVE 2018	Presentation of RESOLVE, showcase of D1	Piaggio	9-11 July 2018	Milan

Final event

The final event of the project is worth a special mention.

About 80 participants joined the RESOLVE Final Event in Brussels on 25 April 2018.

Opened by the Project Officer Georgios Charampolous and by Antonio Perlot, Secretary General of ACEM, the conference on main results of the project encountered a very positive feedback from an interested audience and hosted a lively debate on challenges and opportunities for electric mobility and future perspectives, involving other projects in the Green Vehicles Horizon2020 framework: ELVITEN, WEEVIL, SILVERSTREAM, ESPRIT.

The two vehicle demonstrators developed in the project and an additional three-wheeler demonstrator named D3 have been showcased and received a very positive feedback from an interested audience.

Furthermore a comprehensive exhibition helped the audience to touch project results: on achievements in the different project areas, videos on vehicles supported the Consortium to give an exhaustive and exciting overview of achievements of RESOLVE.

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4. Liaison Activities

Over the project life, RESOLVE has stimulated a debate on how light electric vehicles could concretely be an alternative to ICE vehicles in particular for urban mobility.

Liaison and networking activities have been promoted, as well as participation to initiatives within the transportation domain and in particular concerning light electric Mobility.

Main scopes were to:

- Promote solutions towards sustainable and efficient Mobility
- Share and consider the latest developments regarding electric vehicles at EU level
- Analyse the importance of investing in electric and alternative vehicles, also in a perspective of economic growth and job creation
- Explore and promote the benefits of using an electric vehicle, in particular light electric vehicles, as an alternative to ICE vehicles.

Some events were organized under the umbrella of two relevant entities in Europe, active in green mobility and networking vehicle manufacturers, such as:

- EGVI, as a public-private partnership endorsing research and innovation regarding green technologies for cars and other mobility systems used for road transport;
    - EGVIA -ERTRAC 1st European Conference Results 2018
    - TRA conference 2016 and 2018, where RESOLVE has been presented at the EGVI booth
    - Update of the EGVI website in 2018, where RESOLVE has shared latest project results
- ACEM, the European Association of Motorcycle Manufacturers, is the trade association that represents manufacturers of powered-two and three-wheelers as well as quadricycles (L-category vehicles) in Europe.
    - ACEM conference 2016
    - ACEM conference 2018, where RESOLVE has presented the vehicle prototypes developed in the project.

Liaison activities have been carried out also with other projects within the Green Vehicle initiative:

- Workshop organized by EU projects Esprit and Weevil “The transition to light electric vehicle: an opportunity to disrupt urban mobility?” in 2017, where RESOLVE has shared a presentation and joined the debate
- “Improving Energy Efficiency In Electric Vehicles” event organized by XERIC, JOSPEL and OPTEMUS projects in 2016, which RESOLVE has joined
- Electric Connected Automated Cars invented for the 2030 Customer - "Moving Towards Human Centered Mobility" Workshop, to be held in July, which RESOLVE will join.
- RESOLVE final event on April 25 2018, where representatives of SILVERSTREAM, WEEVIL, ELVITEN, ESPRIT shared project results and joined the debate on challenges and opportunities for electric mobility and future perspectives.
- Presentation of RESOLVE with focus on HMI at the final event of SILVERSTREAM, at the ECAS Conference

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5. Assessment

Over the project life, several means to present RESOLVE and its results have been identified: since the time of proposal writing, quantitative criteria have been set, in order to assess the Dissemination and Communication activities.

Criteria selected have included scientific publications, conferences, direct private conversations (e.g. with consumer associations, industry watchers, companies who have expressed an interest in adopting RESOLVE vehicles for corporate reasons, and policy makers looking to fulfil urban needs), website visits, trade shows, press releases and reach-through communications.

As pointed out in Table 3, all of the thresholds set per each criteria have been met.

Due to confidentiality issues on results, it was decided to not create any RESOLVE social media profile, but to rely on different means able to create anyway a debate on strategic topics related to the project, e.g. liaison activities, participation to conferences and events, prototype showcase at trade shows.

The feedback from the audience has been positive, both from the specialist and general public and from the press, as confirmed by the number of reach-through communications.

Table 3 - Dissemination and Communication targets

Channel	Targets	Metrics planned	Metrics achieved
Scientific publications	R&D community	# papers > 8	17
Conferences	R&D community, industry, policy makers/advisors	# presentations > 15 Audience > 1,000	19
Private conversations	R&D community, policy makers/advisors, industry	# conversations > 10 in total	11
Project website	Everyone	# visitors > 300/month	2017: Average visits: 2,055917 2018: Average visits: 4,8362
Trade shows	Enthusiasts, industry, public	# interacting visitors # mentions in press > 3	7
Reach-through communications	Public	Reach > 100,000 # articles > 50	54

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6. Exploitation of research deliverables by OEMs and other industry partners

As mentioned in Grant Agreement (653511 – RESOLVE – Part B, p.32): "the primary route for exploitation of the RESOLVE results is through direct sales of ELVs and ELV components by industry consortium partners. A secondary route is through licensing of RESOLVE Intellectual Property (IP) to third parties. A tertiary route is through consultancy and research contracts by research partners".

This section refers to the exploitation of research deliverables by OEMs and other industry partners that primarily happens through direct sales of ELVs and ELV components. To this purpose, it is necessary to analyze market potential and the cost constraints, due to these are the well-known constraints to ELVs diffusion.

6.1. Marketing potential

6.1.1. D1 Demonstrator market positioning

During the last few years, the European electric scooter market recorded a significant growth (133,4%) from 2016 to 2017, with the number of registered vehicles which rose from around 5.750 to over 13.400. Thus, while in 2016 electric scooters accounted for 0,8% of the scooter market, in 2017 the percentage increased to 1,9% (Figure 9).

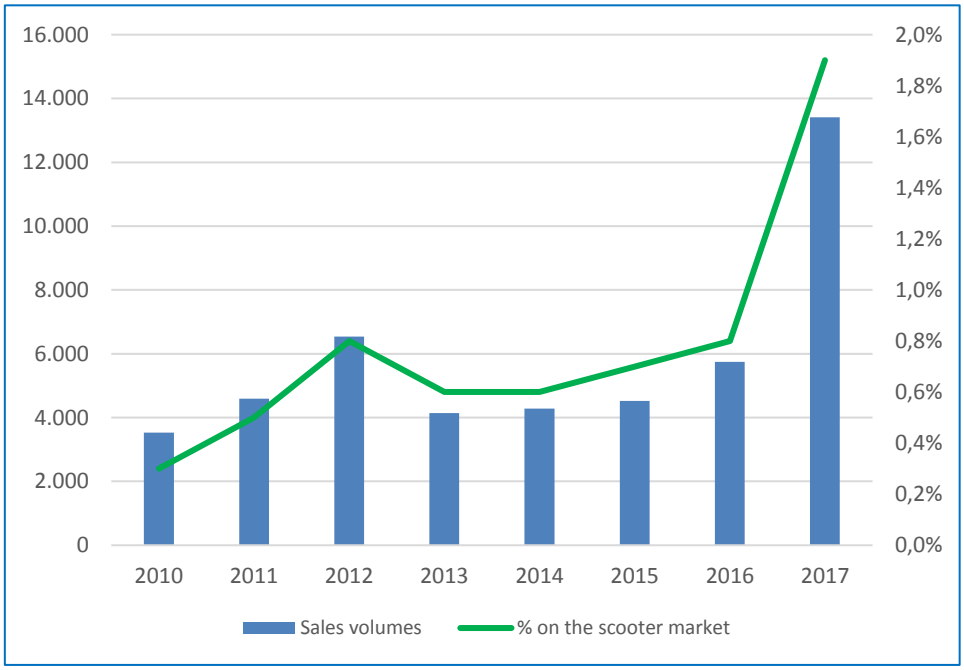

Figure 9 – Electric scooter sales (2010 - 2017) – Source: OEMs' analysis based on internal databases.

However, looking more in detail at the data, it emerges a different behavior for electric mopeds and quadricycles, because mopeds point out a significant increase while quadricycles have a more fluctuating trend (Figure 10 and Figure 11).

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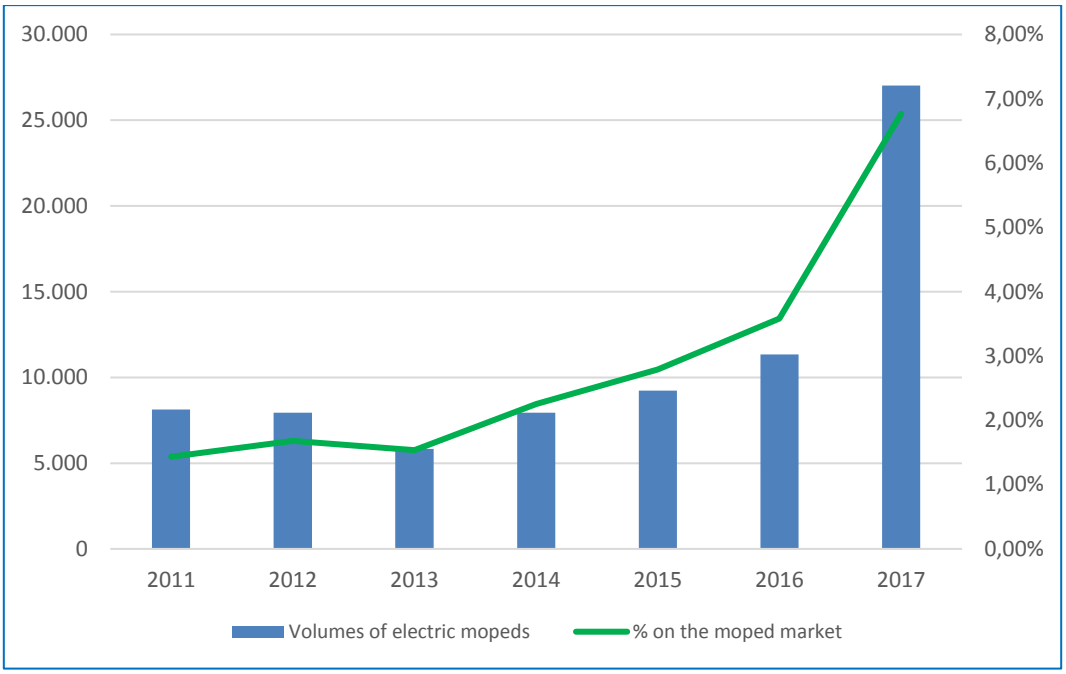

Figure 10 – Electric mopeds registrations in the European Union (2011 – 2017) – Source: ACEM 2018

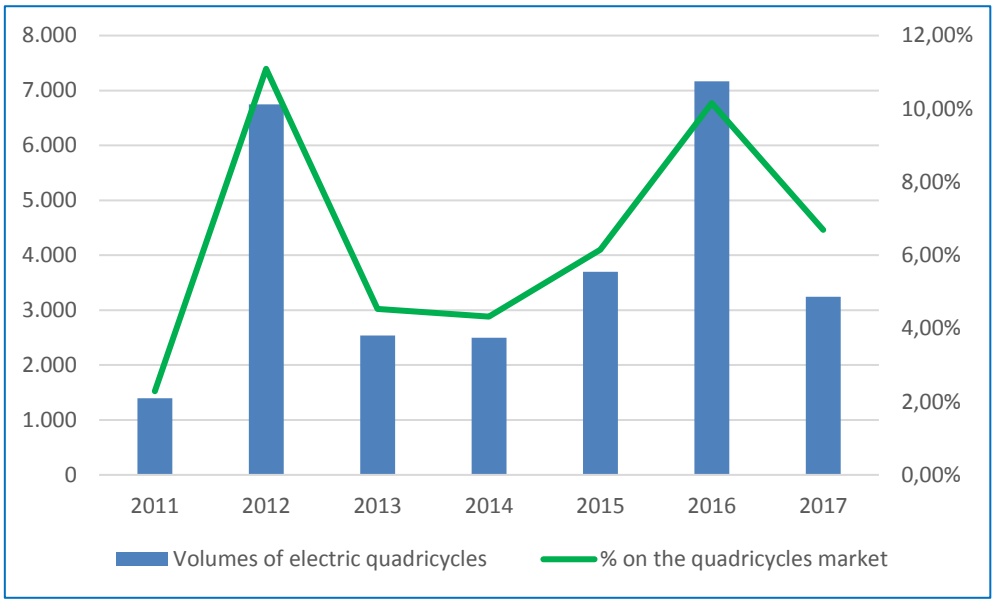

Figure 11 – Electric quadricycles registrations in the European Union (2011 – 2017) – Source: ACEM 2018

Another relevant aspect concerns the type of favorite scooters within the market. In fact the characteristics of these scooters represent useful information to support the development of new products. Figure 12 shows that in the European Scooter market more than 75% it is made of vehicles between 50 and 125 cc.

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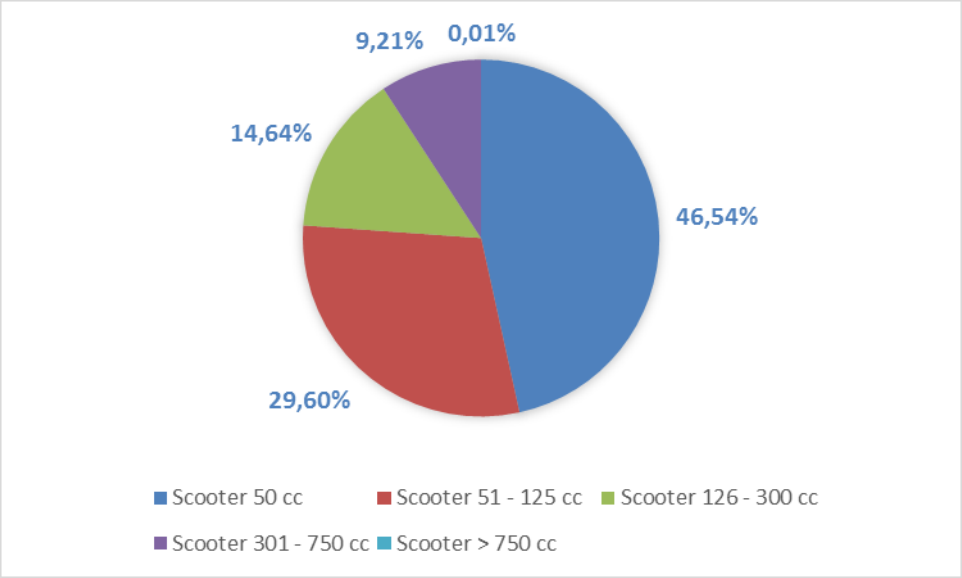

Figure 12 – European Union Scooter market distribution (2017) – Source : OEMs' analysis based on internal databases.

Looking at 50 cc vehicles, it results that the average price is around 1.500 € (Table 4).

Table 4 – Estimated average price (scooters 50cc - 2017)[1] – Source: OEMs' analysis based on internal databases.

Model	Volumes	Price
SCOOTER 50 (China)	48.587	1.000 €
SCOOTER (CHINA) 50 25km/h	27.423	1.000 €
Kymco AGILITY	6.685	1.299 €
SYM ORBIT 50	5.883	1.299 €
Peugeot KISBEE 50	17.658	1.300 €
Piaggio ZIP 2000 2T	9.601	1.350 €
Piaggio ZIP 25 km/h	7.184	1.790 €
Vespa 50 PRIMAVERA 2T	8.839	3.000 €
Vespa 50 PRIMAVERA 4T	7.244	3.280 €
Vespa SPRINT 25km/h	7.356	3.750 €
Weighted average price		1.495 €

However, the previous table highlights that on the reference market there is space also for scooters having higher prices if these models have attractive characteristics in terms of brands, style and functionalities (e.g. Vespa).

1 Calculation based on EU volumes and on price lists of the European country which registered the highest number of sales of each scooter. Prices refer to the direct sale of vehicles.

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An in-depth analysis shows that more than 75% of such a market counts lower 1.500 €, with a 16% peak over 2.500€, located in the area ruled by the most exclusive 50cc scooter, such as Vespa Primavera/Sprint (Figure 13).

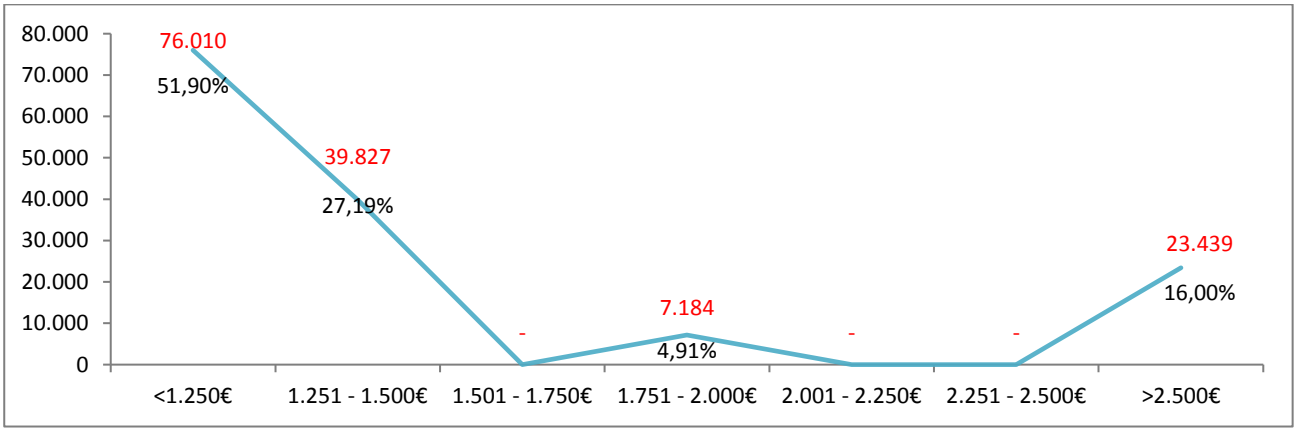

Figure 13 – Average price distribution (scooters 50cc - 2017) – Source: OEMs' analysis based on internal databases.

On the other hand, average price for scooters over 50cc and <125cc is about 3.350[2] €, as shown in Table 5. This analysis also takes into consideration scooters over 50cc because electric scooters classified as mopeds usually have an acceleration higher than combustion ones and can be compared, for urban use, to 110cc and 125cc scooters.

Table 5 – Estimated average price (scooters between 51cc and 125cc - 2017) – Source: OEMs' analysis based on internal databases.

Model	Volumes	Price
Kymco AGILITY 125 R16	11.618	1.990 €
Honda VISION 110	7.679	2.250 €
Piaggio LIBERTY 125 ABS	10.128	2.390 €
Sym SYMPHONY 125	6.499	2.400 €
Honda PCX 125	17.984	2.899 €
Yamaha N-MAX 125	11.562	3.099 €
Piaggio MEDLEY 125	8.048	3.290 €
Honda SH 125	19.404	3.440 €
Vespa 125 PRIMAVERA	9.282	4.320 €
Honda FORZA 125	12.213	4.949 €
Yamaha XMAX 125	8.735	4.999 €
Vespa GTS 125 SUPER	5.042	4.999 €
Weighted average price		3.361 €

50% of selling is related to vehicles with a price lower than 3.250 €, while the high-end segment accounts for 20% of sales (Figure 14).

2 Calculation based on EU volumes and on price lists of the European country which registered the highest number of sales of each scooter. Prices refer to the direct sale of vehicles.

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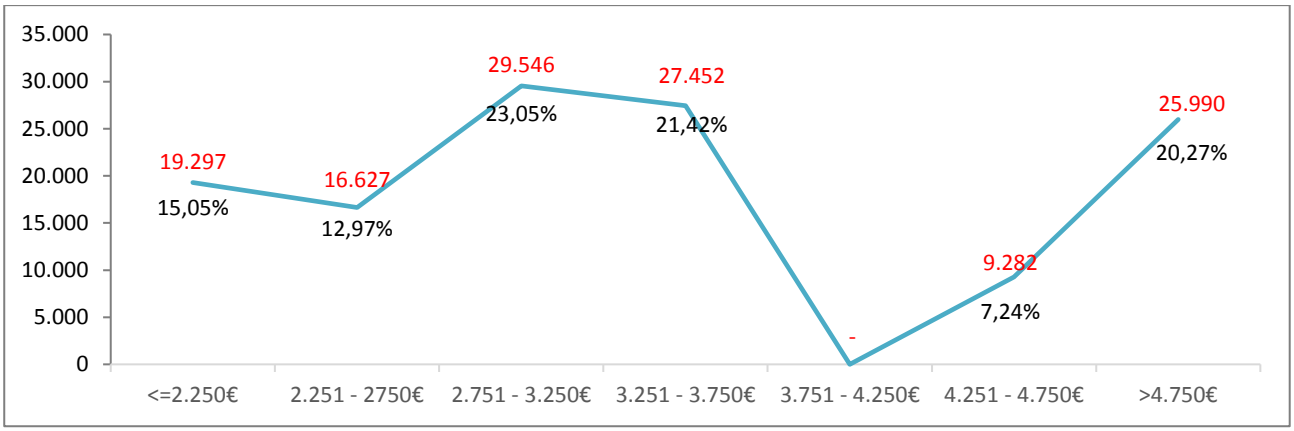

Figure 14 – Average price distribution (scooters between 51cc and 125cc - 2017) – Source: OEMs' analysis based on internal databases.

Hence it emerges that within the EU context, the short range mobility demand is satisfied by vehicles that have a relatively cheap purchasing cost for the end user (purchasing cost < 3.250 €), low operating costs (i.e. engines with moderate performances, about 2-4 kW for 50 cc and 7-9 kW for 125 cc (except for Honda Forza and Yamaha XMAX with a maximum power of 11 kW), suitable for drivers with only car license, easy to ride and park. Furthermore, consumers seem to appreciate differentiation of vehicles because there is also space for more costly vehicle having special characteristics (e.g. brand, design and riding characteristics). These vehicles are purchased because are an economic solution to traffic jam in urban environment, are light and suitable for customers that do not need deep technical knowledge but are oriented to functional capacity and reliability. Moreover, in recent years new vehicles appeared able to ensure very low consumption levels, up to 50 km/liter (i.e. Honda SH and Vision, Piaggio Liberty ABS, Vespa Sprint/Primavera).

The above-mentioned analysis shows that the private customer will eventually consider an alternative mobility solution if this alternative is offered with a favorable ratio between price and vehicle characteristics.

Analyzing quality/premium conventional scooters between 50cc and 125cc (except maxi GT scooters), the price in 2017 – not considering special discounts or incentives – varies from 2.200 to 6.000 €. Yearly usage, mainly in urban areas, reasonably counts for an average distance between 4.000 and 6.000 km. Hence assuming the following hypothesis:

- a distance of 6.000 km/year,
- 5 years as period of ownership,
- 1.300 € as terminal value,
- an average consumption of 20 - 30 km/liter, 1,5 €/liter fuel cost (Italy 2017) (hence fuel costs results to be about 450 - 300 €/year and roughly 25 - 38 €/month),
- road tax: 20€ for 50cc scooter; 30€ for 125cc (web simulation);
- service maintenance: 70€ for 50cc; 90€ for 125cc (web simulation);
- insurance costs are not included (this cost could be a lever used by policymakers to support ELVs diffusion);

It is possible to estimate the total cost of ownership for the end user (Table 6 summarizes the main assumptions).

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Table 6 – Average monthly total cost of ownership (simulation for a scooter between 50cc and 125cc – 2017 - *Insurance costs are not considered.) – Source: OEMs' analysis based on internal databases.

Estimated price for the end-user (quality/premium ICE scooter between 50cc and 125cc)	4.300 €
Average monthly depreciation (assuming 5 years as period of ownership and 1.300€ as terminal value)	3.000 / (12 * 5) = **50 €**
Estimated Annual fuel cost (assuming a distance of 6.000 km/year; an average consumption of 25 km/liter and 1,5 €/liter fuel cost)	360 €
Estimated Road tax cost (mean value for 50cc and 125cc)	25 €
Estimated annual maintenance cost (mean value for 50cc and 125cc)	80 €
Average monthly cost for vehicle usage	(360 + 25 + 80) / 12 ≈ **39 €**
Average monthly Total Cost of Ownership (ownership + usage)	**50 + 39 ≈ 89 €**

In conclusion, market analysis points out a potential for electric scooters (mopeds); however, any alternative to internal combustion engine scooters (such as an electric/hybrid vehicle[3]) must be competitive with such values, in order to stimulating the willingness to use and/or to purchase a different vehicle. Electric/hybrid vehicle will compete with internal combustion engine (ICE) scooters not only on the price but also on performance, style, functionalities (e.g. cargo capacity, riding pleasure and safety). Hence an ELV higher price could be balanced increasing its usefulness and riding pleasure. Nevertheless, in the near future the diffusion of electric vehicles will be boosted by new legislation on polluting emission. For example, from 2018 the production of Euro 2 and Euro 3 scooters is no longer permitted, with a few exception, causing consequent changeover to Euro 4 vehicles (Source: Regulation No 168/2013 of the European Parliament and of the Council). The new regulation necessarily increases the production costs of ICE scooters and therefore purchase prices of basic scooters too.

Coming back to D1 Demonstrator, its proposal is very different respect a conventional ICE scooter (i.e. safety, style, cargo capacity, fun drive). Hence, it these distinctive characteristics will be properly communicated to the potential users, they should increase the willingness to pay for this new vehicle. From the cost side it is appropriate to take into account that an electric vehicle such as D1 Demonstrator has a lower cost usage than an ICE vehicle. Table 5 describes the D1 demonstrator TCO, based on an estimated price for final user ranging from € 8.000 to € 10.000.

Table 7 – Estimated average monthly total cost of ownership for D1 Demonstrator - Source: OEMs' analysis based on internal databases.

Estimated price for the end-user (a price range is considered: 8.000€ min. and 10.000 € max)	8.000 € (10.000 €)
Average monthly depreciation (assuming 5 years as period of ownership and 2.500€ (3.000) as terminal value)	5.500 (7.000) / (12 * 5) = **91,67 € (116,67€)**

[3] It is taken for granted that such electric/hybrid vehicle will have no technical limitations in terms of range and recharging capability.

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Estimated Annual kWh cost (assuming a distance of 6.000 km/year, a consumption of 4,4 kwh/100 km and 0,26€ as price per kw/h)	68,64 €
Estimated Road tax (value for 50cc, Italy, source ACEA 2018)	0,00 €
Average monthly cost for vehicle usage	(68,64 /12) = **5,72 €**
Average monthly Total Cost of Ownership (ownership + usage)	**91,67 (116,67) + 5,72 ≈ 97 € (122)**

6.1.2. D2 Demonstrator market positioning

Concerning the D2 Demonstrator vehicle, the competitors' analysis also includes vehicles of categories other than L6 but which are similar to it in terms of size, safety level, load capacity and weather protection. It results that the average price of these vehicles on the European market is about 13.150 € (Table 8).

Table 8 – Estimated average price for L6 vehicles and similar categories – 2017 - Source: OEMs' analysis based on internal databases.

Model	Volumes	Price
Ligier JS50 dci	1.224	11.190 €
Renault TWIZY 45	108	11.800 €
Ligier PULSE 3	1.473	12.821 €
Aixam S8 (480cc)	1.101	14.090 €
Aixam E-CITY	24	14.690 €
Microcar M.GO 505	750	15.290 €
Estrima BIRÒ	114	15.590 €
Weighted average price		13.134 €

An analysis of this market from Figure 15 shows that half of the sales are concentrated in the price range 12.751 - 13.500 €, while sales volumes are significant also below 12.000 € and above 15.000 €.

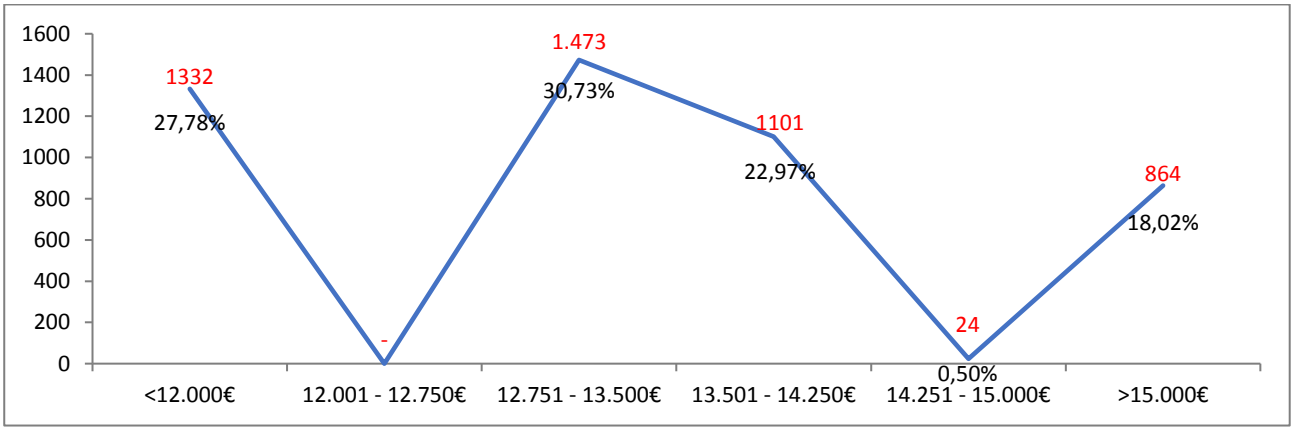

Figure 15 – Average price distribution for L6 vehicles and similar categories – 2017- Source: OEMs' analysis based on internal databases.

As demonstrated by the low sales volumes (Figure 15), the market for L6 vehicles and those of similar categories represents a niche market in Europe.

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Despite sales prices are at the level of those of conventional small cars, these vehicles are purchased because they are light and suitable for urban transport. The small size combined with a certain amount of load capacity allows to target businesses which deliver in city centers.

An alternative mobility solution such as the D2 Demonstrator vehicle will only be considered if it will be offered with a favorable ratio price/vehicle characteristics.

In order to identify an average total cost of ownership as possible benchmark for the D2 Demonstrator vehicle, two quality vehicles – one with an internal combustion engine and the other with an electric motor – are here taken into account: the Aixam S8 (480cc) and the Aixam e-city.

For these vehicles the price – without considering special discounts or incentives – is between 14.000 and 15.000 €, while the average annual hypothesized distance traveled is 8.000 km. Average consumption and fuel costs (Austria 2017) are respectively 25-27 km/liter (as average 26 km/liter) and 1,16 €/liter for the Aixam S8 (480cc) and 16,5 - 33 km/kWh and 0,18 €/kWh for the Aixam e-city.

The period of ownership is assumed to be 5 years and the terminal value is considered as approximately 30% of the initial price.

Road tax costs in Austria amount to 74,40 € for the Aixam S8 (480cc), while electric vehicles, and therefore also the Aixam e-city, are exempt from this type of costs. Insurance and maintenance costs are not considered.

The main data are summarized in Table 9.

Table 9 – Average monthly total cost of ownership for L6 vehicles and similar categories – 2017 - Source: OEMs' analysis based on internal databases.

	AIXAM S8 (480CC)	**AIXAM E-CITY**
Estimated price for the end-user (quality ICE and electric vehicles of categories similar to L6)	14.090 €	14.690 €
Average monthly depreciation (assuming 5 years as period of ownership and respectively 4.200€ and 4.400€ as terminal value)	9.890 / (12 * 5) = **164,83 €**	10.290 / (12 * 5) = **171,50 €**
Estimated Annual fuel/energy cost (assuming a distance of 8.000 km/year)	356,92 €	58,18 €
Estimated Road tax	74,40 €	0 € (source: ACEA 2018)
Average monthly cost for vehicle usage	(356,92 + 74,40) / 12 = **35,94 €**	58,18 / 12 = **4,85 €**
Average monthly Total Cost of Ownership (ownership + usage)	**164,83 + 35,94 ≈ 201 €**	**171,50 + 4,85 ≈ 176 €**

For D2 Demonstrator, the possible selling price for the vehicle developed by KTM could range from 10.000 to 11.000.

Table 10 – Estimated average monthly total cost of ownership for Demonstrator D2 - Source: OEMs' analysis based on internal databases.

Estimated price for the end-user (a price range is considered: 10.000 € min. and 11.000 € max)	10.000 (11.000) €
Average monthly depreciation (assuming 5 years as period of ownership and € 3.000 (3.500) as terminal value)	7.000/(12*5) =116,67 € 7.500/(12*5) = 125 €

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Estimated Annual fuel cost (assuming a distance of 8.000- km/year, a consumption of 5,4 kw/h/100 km and 0,26 € as price per kw/h)	112,32 €
Estimated Road tax (source: ACEA 2018)	0,00 €
Average monthly cost for vehicle usage	112,32/12 = 9,36 €
Average monthly Total Cost of Ownership (ownership + usage)	**116,67 + 9,36 ≈ 126 €** **125 + 9,36 ≈ 134 €**

6.1.3. ELVs Business model innovation: insights from RESOLVE project

In order to push a wide spreading RESOLVE's vehicles concept, some alternative hypotheses to the direct selling business model are needed. Different possibilities are taken into consideration and analyzed in order to better understand how to reach potential customers, meet their needs and willingness to pay for an Electric LV. In fact, as for car sector, final users (city dweller) does not strictly need to purchase a vehicle (2, 3 or 4 wheels) but they are looking more and more for an effective and efficient solution for their mobility needs. Even more people are shifting from ownership to sharing formulas. Such a phenomenon is not restricted to the so-called "early adopters" but is becoming quite common. For instance, the Italian Car2Go and Enjoy4 experiences are demonstrating how sharing mobility is considered a valuable answer to the urban mobility issues. Besides cars, such formula is dealing with bicycles and scooters (i.e. MP3 300 Enjoy). It is proof that customers are more interested to the service (offered at a reasonable price) than the type of the vehicle itself. Alternative business models to the direct selling are introduced below.

Vehicle leasing

The complete vehicle is sold with a leasing option to the customer, with an initial installment and a monthly fee. At the conclusion of the contract, two options are offered: the vehicle return with no other additional fees or the vehicle purchase with a final high installment.

The vehicle leasing partially solves the problem of initial illiquidity since the customer does not have to pay the full value of the vehicle at the time of signing the contract, but only a part of it.

Although it can also be applied to private users, the leasing formula is mainly designed for enterprises and freelancers as it allows them to have fiscal advantages.

In order to be competitive with the prices of scooters and minicars already on the market, the monthly fee of the RESOLVE vehicles cannot exceed much the monthly typical operating expenses sustained by a scooter or minicar owner.

Long-term rental

The end user pays a monthly fee to come into possession of the complete vehicle without being its owner. Differently from the leasing option, there are no initial or final installments.

This formula is ideal for people who need the vehicle for a limited period of time and those who do not want to assume the obligations and risks of having their own vehicle. Indeed, the duration of the contract can be chosen by the customer and the monthly fee includes ordinary and extraordinary maintenance, insurance, and roadside assistance.

[4] https://www.car2go.com/en - https://enjoy.eni.com/en/milano/trova_auto?flag_auto=mp3

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Generally, if the customer keeps the vehicle for a short period (e.g. some months), he/she pays overall less than buying one. Following what happens in the electric scooter market, Piaggio and KTM have two different options to offer their new vehicles with the long-term rental formula: offering this service directly to the end users as the Italian manufacturer ME[5] does, or selling the vehicles to companies which then provide the service to the end users. In both cases the more the scooter is used, the more the fixed manufacturing costs are shared among users, with the possibility to lower their costs. Of course profitability for OEMs will be different according to the selected option.

Battery hire

One of the main current critical issue of the electric vehicles business is the high cost of the batteries.

To overcome this difficulty and lower the vehicle price and TCO, a solution may be the selling of the vehicle without the batteries and proposing the use of the batteries through a rental or sharing option: practically, with this formula the company capitalizes in the long term the economic benefits related to the batteries by turning customers' high initial investments into a supply service. The private customer would pay a lower price (vehicle price without batteries) and then pay a separate fee for the battery provision, recharging and management.

In addition to having a price reduction while purchasing the electric vehicle, battery hire reduces consumers' anxiety about the battery as usually it is offered roadside assistance and guaranteed that batteries have at least a certain amount of the original capacity.

Examples of application of this business model are offered by ME[8], an Italian manufacturer of electric scooters, and Renault with its Twizy model[6]. Indeed, both the companies give the possibility to purchase the vehicle and sign a contract for the supply of the battery (without being its owner).

A similar formula has been recently launched in Taiwan (and it is now being tested in Europe) by Gogoro[7]. The company has combined the battery hire system with a battery swap one, capable of increasing the driving range and drastically reducing waste of time. Indeed, its customers have the possibility to choose between charging the batteries they already have and replacing them with charged ones in less than 1 minute. The rationale behind this business model is from one side to give a service to the customer overcoming its anxiety deriving from the battery usage and maintenance. From the other side the battery hire could be a way to increase the battery usage within its useful life, decreasing the incidence of its cost per user (Giannetti et al., 2016).

"Pay x use"

This formula allows to attract people who need to move around the city, but do not want to have any long-term commitment. Indeed, final users pay only for the time they use the vehicle and do not have to worry about fuel, maintenance, taxes and insurance.

Private companies with experience in the vehicle sharing business could easily propose such new vehicles in this market, sustain the significant purchasing cost of the vehicles, and offer a cheap sharing service to the final user. Purchasing more expensive but better quality electric vehicles would mean higher safety for customers while braking and curving and lower maintenance costs in the long term.

Public companies and municipalities, interested in eco-mobility issues, could also join and promote this kind of business initiative since it contributes to reduce traffic and greenhouse gas emissions in cities and therefore to improve citizens health. Energy companies could be involved for the supply and battery management.

This type of business model is becoming increasingly successful thanks to its ability to meet the end users' needs, with the number of European cities where it is possible to find this sharing service which is growing. In particular, among the electric scooters made available by sharing companies there are those produced by Niu, Govecs and Askoll. Estrima Birò has instead developed a platform[8] that allows both individuals and companies to create their own community with which to share their L6 vehicles.

[5] https://scooterelettrico.me/en/me-scooter-en/price-and-financing
[6] https://www.renault.it/veicoli/gamma-ze/twizy.html
[7] https://www.gogoro.com/
[8] http://www.estrima.com/en/biro-share/

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Following CityScoot, eCooltra, GoUrban and MiMoto[9] formulas, private/public companies could offer eco-sustainable urban mobility solutions for final user, such as D1 and D2 Demonstrators. Piaggio and KTM would sell the electric vehicles to sharing companies (or municipalities), while the batteries service would be managed by energy companies. The customer would then simply pay a fee for the use of the vehicle.

The business models (BMs) recalled above are only some examples of possible BMs that can be evaluated and developed in order to overcome the barriers to ELVs diffusion. Further insights on innovative BMs could come from an analysis of the electric car market in order to bring those elements that are not yet present in the less mature sector of L-category electric vehicles and that could be applied in order to favour the distribution of such vehicles. For example, we assist to a growing number of prosumers, subjects that not only consume energy but also produce it, usually through rooftop solar panels, and use it to recharge their electric cars (Hall et al., 2017; Parag and Sovacool, 2016). Encouraging users and businesses to become prosumers would increase the economic benefits of being an owner or a possessor of an electric vehicle, with positive impacts on the adoption of such vehicles.

Hence different business models could be designed and implemented in order to spread Electric LVs. Each BM have pros and cons for consumers and organizations, according to contingencies such as location, user needs etc. Due to the variety of BMs that can be realized, it is useful to give insights about a possible method useful to support their design. As an example of a multidimensional assessment of BM innovation, it is worth to recall that proposed by Weiller et al. (2015). Weiller et al. (2015) designed this framework specifically for the electric vehicle industry, in order to evaluate the business models on the basis of 11 criteria which analyse the financial and practical benefits for customers, the use of innovative technologies, the impacts on customers' behaviours and the possibility to re-adapt the business model to different contexts. The first six dimensions evaluate the way in which the business model enhances diffusion of EVs through the resolution of consumer problems, while the next five concern the process of value creation and appropriation from the supply perspective. Each of the 11 criteria receives a score representing the strength of the business model in creating competitive advantage and favouring a wider adoption of EVs. Scores range from 0 to 5 – where 5 represents the maximal performance – and are then represented in a four-dimensional chart which indicates whether the competitive advantage is related to financial or strategic factors and whether it is due to a customer or business orientation.

Figure 16 shows how the framework suggested by Weiller et al. could be applied on the BM based on the sharing of electric vehicles – also known as the "pay per use" formula. This BM conceives mobility as a service and aims at promoting the adoption of EVs through the reduction of risks and costs for consumers.

In particular, ownership costs for the end users are completely reduced as both the battery and the vehicle are fully owned by the sharing company or by the municipality. Therefore, the business model receives 5/5 for the first two dimensions of the framework.

Customers are protected from variations in electricity prices (5/5) since the cost of electric recharge is fully included in the price paid for the use of the electric vehicle.

The business model scores 4/5 in spreading the risks across the ecosystem. Indeed, risks of adoption do not fall on consumers but on sharing companies (or municipalities), with a positive impact for a wider adoption of electric vehicles. Moreover, the organization offering the service can count on the contribution of other actors such as energy suppliers for vehicle recharging and the supplier of electric vehicles for technical guarantees.

Since the sharing service is designed for urban areas, the business model does not address the problem of driving range limitation and therefore receives 0/5 on the fifth criterion.

The service is intended as an alternative to public transport and to vehicle ownership and therefore strongly (5/5) promotes a change in the behaviour of citizens and tourists towards more flexible and sustainable transport.

[9] http://www.cityscoot.eu/paris/?lang=en - https://www.ecooltra.com/en/ - https://gourban.at/en/ - https://mimoto.it

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The business model is not designed to facilitate technological improvement of electric vehicles' typical components. However, it proposes steps forward in terms of vehicle connectivity: vehicles are managed by end users through the use of smartphone apps and without keys. Thus, the "pay x use" formula is given a 1/5 score.

Regarding the eighth dimension, the business model receives a 5/5 score as it is clearly innovative for the mobility sector.

The sharing business model receives 2/5 in terms of experimentation and flexibility as, although it may involve the use of different types of vehicles, it is designed specifically for city centres and for those areas with a high population concentration. A smart charging infrastructure is not yet used (0/5).

As underlined several times, the business model is fully service oriented and therefore receives a 5/5 score for the last dimension.

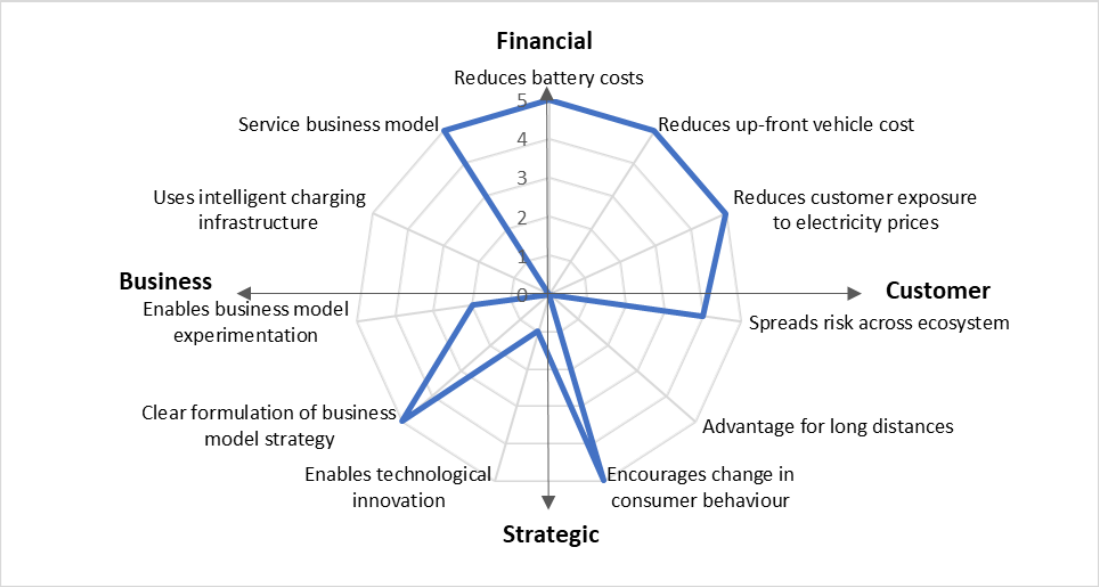

Figure 16 – Evaluation of the "pay x use" business model – Source: adapted from Weiller et al. (2015).

The evaluation scheme could be applied both to the other BM types described before and, eventually, to the hybrid solutions obtained combining them. In this way it is possible to point out strengthens and weaknesses of each solutions, supporting innovative business model design. However in this vein more research is needed, the RESOLVE project confirms that Electric LVs diffusion seems based on a proper design of vehicle/powertrain but also on a consistent BM structure, furthermore it emerges that effective BM should be designed adopting a contingent and multidimensional approach.

6.2. Cost reduction initiatives

ELVs cost is one of the most relevant barriers to their spreading and cost reduction is a necessary premise to the exploitation of RESOLVE results. In this section are outlined the main actions and results obtained by OEMs and their industry s' partners. During the project partners have been engaged in the powertrain cost reduction, applying strategies such as functional integration, modularity, scalability and application of state-of-the art low-cost solutions already existing in automotive field suitable for L-category vehicles. In particular, several components were interested by cost effective solutions.

Electric Motor

The cost-effective initiatives related to D1 electric motor comprehends: ad-hoc design for integration in the swingarm; focus on high efficiency design; integrated planetary gear reduction; focus on just air-cooled components. Cost effective solutions for D2 electric motor are: use of an electrical excited synchronous machine

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with ferrite magnets instead of neodymium magnets; integration of motor and inverter (complete power and signal cabling is realized internally in the drive unit); Efficient air forced cooling of the machine by openings in the end shields and internal fans on the motor shaft; high synergies with high volume production of claw-pole machines for automotive applications.

Battery Pack

The aim of the project was to design universal 48V battery module scalable in capacity which will meet the expectations of various ELV. To improve modularity and scalability of whole battery module a few concepts have been made. Using special designed connection tabs, snap fasteners and covers finally the main thought has been reached. Modules can be easily positioned, mounted and connected with each other in two directions – horizontal and vertical providing capacity expansion from 4P to any multiple of that serial. The intention was to show as much ways of fixing battery module in the enclosure as possible so mounting holes and groves which haven't been used in modules assembly are also capable to fix whole battery pack to the case. It gives wide opportunities to integrate a battery with customer vehicle keeping endurance and stiffness which satisfied a condition of LEV and some semi-structural designs. This permits to face the increasing price trend of Li-Ion cell, especially in 2018 because Li-Ion situation is changed drastically compared to the beginning of the RESOLVE project (Avicenne Energy, 2018[10]):

- raw materials Li and Co increased 3- or 4- times (i.e. Co is 95-100 USD/kg, compared to ~23 USD/kg beg.2016);
- availability of raw materials is uncertain, world OEM corporations secure materials by long-term contracts (Apple, VW, BMW) by investing $ Billions;
- possibility of cells' shortages for non-OEM's makes us to accept higher prices or lose the Purchase Orders;
- statistical oversupply is about 10%, but just theoretical, several cell types are simply unavailable, or the lead-times are huge long, i.e. 60-65 weeks;
- cell manufacturers enforce prices, select only best promising projects and accept only confirmed orders in 15-18 months time perspective;
- power sources market is booming;
- raw materials will see demand doubling or tripling till 2025.

Yet cell prices growth was compensated by reduction of battery components costs and it's possible to keep the same cost in 2018-2020. This last trend is a favorable factor for ELVs diffusion.

Drivetrain Management Module (DMM)

The Drivetrain Management Module (DDM) is an integrated electronic system that preforms the following main function: Inverter; Traction battery charger; DC/DC converter from traction battery to 12V battery; Vehicle management unit; External range extender management; Regenerative braking capabilities. DMM is able to combine powertrain components with the scope to reduce weight, space and overall costs.

Low cost Solutions

Another approach to gain cost savings that is transferring low-cost solutions from existing technologies in automobiles; this reduces time and effort needed and avoids incurring of additional development costs.

6.2.1. Cost reduction effects

The effect of the actions by component taken in place by RESOLVE is shown in Table 11.

[10] www.avicenne.com. Avicenne is a market research and consulting firm providing clients with strategic, marketing, technical and financial information to support profitable growth

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Table 11 - Cost reduction effects

Demonstrator	**D1**	**D1 with DMM (D1b)**		**D3 (single powertrain with DMM)**		
Component	% on total cost of components (marginal cost)	% on total cost of components	saving D1b vs D1	% on total cost of components	*saving D3 vs D1*	*saving D3 vs D1b*
a) Drivetrain	37,8%	33%	-18,9%	21,8%	-59,5%	-50%
b) Battery pack	25,2%	27,1%	0%	35,9%	0%	0%
c) Drivetrain components (a+b)	63%	60,1%	-11,4%	57,7%	-35,7%	-27,4%
d) Vehicle components	37%	39,9%	0%	42,3%	-20%	-20%
e) Total components (c+d)	100%	100%	-7,2%	100%	-29,9%	-24,5%
f) Cost without batteries (e-b)	74,8%	72,9%	-9,6%	64,1%	-39,9%	-33,6%

The estimated cost of demonstrators is split into major components which name is reported in column 1.

D1 demonstrator (Tilting 4-Wheeler with two powertrains) and D3 (Tilting 3-Wheeler with single powertrain and DMM) are those realized within RESOLVE project while an additional hypothetical prototype, named D1b, has been added (Tilting 4Wheeler with two powertrains and DMM), in order to evaluate possible saving per component.

For confidential reasons marginal cost (i.e. total cost of components) and not full cost is applied and absolute values of cost are not reported here, but they are replaced by percentages.

D1

Updated total cost of D1 demonstrator is in line with preliminary cost analysis reported in Deliverable D1.3. Due to mechanical complexity of the solution (two e-motors) and the high efficiency of the vehicle, drivetrain cost is about marginal cost, while battery pack costs accounts only for 25%.Therefore cost of vehicle without batteries is reduced to 75%, not particularly making effective business model of batteries hire.

D1b

Even if it was not realized, such an intermediate solution could be easily built up, showing how important is the design choice that led to DMM realization. Considering only such a component, saving of drivetrain is 19% and total saving on vehicle cost is 7%. In such a scenario battery cost is more relevant and business model of batteries hire is more promising.

D3

D3 demonstrator is born to offer a wide and complete range of electric tilting wheelers. A significant design review of vehicle architecture has been carried out, keeping the same front suspension system of D1 but simplifying rear suspension (one wheel and e-motor less). Final cost is more aggressive, paying something in terms of functionalities (i.e. possibility to stand upright during short stops with brakes) and overall impression of potential customer (i.e. perception of more stability and safety). On the other hand vehicle cost is 20% less and

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drivetrain cost (one e-motor+DMM) is 60% less compared to D1. Overall D3 vehicle cost is reduced by 30% respect to D1. Percentage of battery cost increase proportionally, making more attractive a possible formula of batteries hire (D3 without batteries is 64% than complete one).

6.3. Piaggio's exploitation interest

Piaggio's exploitation aims have been revised and at the end of the project are:

1. Development of RESOLVE D1 demonstrator, a L2e-category vehicle (Maximum vehicle speed 45 km/h; 4kW max continuous power) with the following characteristics:
   a. Tilting four wheelers vehicle (distance between rear two wheels narrower than 460 mm)
   b. Open passenger seat (saddle) for two occupants
   c. Light vehicle (curb weight 200 kg)
   d. Equipped with two electric brushless hub motors with bar technology; 4,5 kW continuous power @ 6000 rpm each; 16 Nm continuous torque; 23 Nm max torque (standing acceleration);
   e. Energy recuperation during braking; reverse gear limited @ 5km/h
   f. Charger suitable for home recharge
2. Developing and realizing Drivetrain Management Module, highly efficient in terms of:
   a. energy consumption
   b. cost through design (4kW drivetrain management module (DMM) is expected to cost €500 for 2000 volume per year)
   c. cost through modularity - in order to allow the implementation in different vehicles with different output power, realizing a economies of scale to reduce costs. For such a purpose an additional RESOLVE D3 demonstrator, tilting three-wheelers, has been realized (Deliverable D6.7), aimed at showing transferability of solution.
3. Design and development of modular and swappable battery packs with the following characteristics:
   a. 3,1 kWh on board energy through 2x3 modules assembly
   b. Lithium-ion cells (Standard 18650-type cells, single elementary pack below 60V)
   c. BMS (Battery Management System) with SOC (State of Charge) and SOH (State of Health)
   d. estimation
4. Design of HMI concept for ELV which will integrate standard and mandatory driving information with a new set of information needed for ELVs (such as Smart Range Management for reducing driver range anxiety) with the following features:
   a. Delivery of real time helpful information (e.g. use of the regenerative braking, tips to maximize the energy efficiency)
   b. Provision of reliable and affordable range setups that meet mobility needs, or more specifically, that result in a reasonably high comfortable range
   c. Possibility of distributing information on different displays (main cluster or nomadic device) according to the condition of use and the nature of the information to be provided.

6.4. KTM's exploitation interest

KTM's exploitation aims are:

1. Development of a L6e-B (according to definition of regulation 168/2013, Annex I) category vehicle with the following characteristics:
   a. Tilting four wheelers vehicle (distance between rear two wheels narrower than 460 mm)
   b. Partly or completely closed passenger compartment
   c. A sit-on position as described in deliverables WP1 is likely
   d. Light and efficient vehicle
2. Developing and realizing pure electric powertrain components, highly efficient in terms of:

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a. energy consumption
b. cost through design
c. cost through modularity - in order to allow the implementation in different vehicles with different output power, realizing a real scale economy to reduce costs
d. propulsion battery architecture allows scalability (increased power/energy) and geometrical shape; expected reduction of investment and development cost for implementing a propulsion battery of the same architecture in other vehicle types (i.e. L5e)

3. Flexibility of vehicle architecture to fit to other than L6e-B vehicle categories:
   a. distance between wheels equal or less than 460mm to provide flexibility in terms of number of (considered) wheels → vehicle architecture suits also to L5e (three-wheeler) category
   b. basic vehicle layout provides flexibility to be adopted to other L-category vehicles with reduced effort compared to starting from a "blank sheet of paper".

6.5. Industry partners' exploitation interest

This paragraph shows a brief description of exploitation interest of Industry Partners: Robert Bosch Gmbh (Bosch), Magneti Marelli S.P.A (Magneti Marelli) and Wamtechnik Spolka Z Ograniczona Odpowiedzialnoscia (Wamtechnik); it represents their contribution to reach exploitation goals of two OEMs and, indirectly, skills developed to provide these requirements.

Bosch exploitation aims are:

1. Developing and realizing pure electric powertrain components, highly efficient in terms of:
   a. energy consumption
   b. cost through design
   c. cost through modularity - in order to allow the implementation in different vehicles with different output power, realizing a real scale economy to reduce costs
2. Receive performance data for the developed drivetrain for pure electric L-category vehicles.
3. Figure out the requirements of manufacturer/users to optimize the drivetrain performance.
4. Address the real needs of Piaggio and KTM's users' target to establish a durable collaboration as drivetrain system supplier.

Magneti Marelli's exploitation aims are:

1. Developing and realizing a new electric motor and control electronics:
   a. Suitable for electric or hybrid electric vehicles within L-category;
   b. Low voltage, 2 to 4 kW power
   c. Air cooled
2. Developing and realizing a VMU (Vehicle Management Unit), a common hardware platform with basic software, able to get together and run control strategies from third parties.
3. Getting data and information/suggestion from manufacturers and other partners in order to improve performances and energy savings.
4. Using the components developed and the know how achieved to develop a complete scalable range of electric power modules for L category vehicles, in order to optimize costs through modularity.

Wamtechnik's exploitation aims are:

1. Development of modular battery system for L-category vehicles with the following characteristics:
   a. 48V low voltage system standard (safety)
   b. Scalable capacity (range demand)
   c. Flexibility of mechanical configuration
   d. Cost-effective solution based on 18650 size cells

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2. Development of Battery Management System with the following characteristics:
    a. 48V as standard
    b. Integrated, cost-effective solution based of proven of the shelf components
    c. High level of battery protection

7. Exploitation of project deliverables by Knowledge Intensive Business Services organizations (KIBS)

7.1. Strategic learning and KIBS organizations

The term "learning" apply to both an output (what was learned) and a process (how it was learned) (Argyris and Schon, 1998: 15). The former refers to the amount of information, which becomes a knowledge or a competence, the later refers to the process of learning. Therefore, in other words, we have to deal with individual and organizational learning, some researchers equate individual learning with organizational learning, while others see the two as distinct process (Popper and Lipshitz, 2000: 182). We adopt the perspective of those authors as Argyris and Schon (1978, 1996), who claim that organizational learning takes place when "inventions and evaluations of individual members are embedded in organization's theory in use" (Popper and Lipshitz, 1998: 184), where the theory in use is the set of values, action strategies, assumptions embedded in routine activities. Strategic learning occurs when organization interacting with the environment, through the people belonging to the organizations, and implementing deliberate strategies, receives unexpected answers and consequently, it must reframe the planning and the execution of strategies through new knowledge and/or competences.

This section focuses on strategic learning experienced by RESOLVE project partners such as Austrian Institute of Technology Gmbh (AIT), Idiada Automotive Technology Sa (IDIADA), Re:Lab S.r.l (RELAB), University of Florence (UNIFI), University of Warwick (WMG) , Kiska Gmbh (KISKA), Ricardo Deutschland Gmbh (RICARDO), University of Pisa - Department of Civil and Industrial Engineering (UNIPI-DICI), Department of Economics and Management (UNIPI-DEM), and Ceske Vysoke Uceni Technicke V Praze (CTU). These partners should produce strategic learning applying their "theory in use" to the topics faced within the Resolve project. In order to highlight as these partners leveraged their strategic learning, they are classified as knowledge intensive business services (KIBS) organizations. KIBS organizations include many forms of professional services, different types of specialists function, trade promotion and distribution logistics, and educational services (Miles, 2005; den Hertog et al 2011; Zhou et al., 2016). Due to their role in the project, also Universities have been classified as KIBS, although they could be considered as knowledge intensive service (KIS) if the focus is on educational activity (European Commission, 2012).

Some issues are very significant in KIBS organizations: the role of knowledge in production processes, a greater involvement of skilled workers, and the role of intangible inputs in generating outputs. KIBS deal with provision of knowledge intensive inputs in business processes of other organization; they may be considered both processors and producers of knowledge and innovation and they play an important role of knowledge broker in network activities and in the creation and commercialization of new products, processes and services (Gosch et al., 2011: 5). KIBS firms act as intermediaries between knowledge producers and users, they interact not only with similar firms but also with companies of the manufacturing sector (Gosch et al., 2011: 32). It is useful to show how the above-mentioned partners KIBS organization exploit results gained from RESOLVE in terms of strategic learning.

Among KIBS organizations involved in the RESOLVE project it is noteworthy to distinguish "Universities" (UNIFI, WMG, UNIPI DICI, UNIPI DEM, CTU) from "Other KIBS" (AIT, IDIADA, RELAB, KISKA, RICARDO) since there are some differences in their core activities.

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It is well known that the main activities performed by Universities are (Di Berardino, 2013): teaching, research and so-called third mission. The third mission may be defined as the ability to respond to needs of application and dissemination of knowledge, in order to promote social and economic development, and as a kind of economic exploitation of knowledge (Di Berardino, 2013; Tartari and Breschi, 2012).

First of all, RESOLVE project outputs in terms of strategic learning, may produce (and it has produced), individual learning for the members of Universities involved in the project but, also, it permits organizational learning, if increased knowledge is embedded in organizational memories, maps and programs, which store up organizational knowledge, ad as a consequence, in organizational activities. Specifically, RESOLVE strategic learning outputs consist in developing solutions to factors limiting the adoption of ELVs dealing with issues pertaining ELVs such as cost, energy efficiency, attractiveness and willingness to use ELVs.

Strategic learning can be achieved by Universities, also after the conclusion of the project, by following these steps:

- Assessing their educational programs offering and identifying potential improvements to be made, e.g. updating courses already held with new topics based also on knowledge coming from the RESOLVE project.
- Sharing with other members of the organization (University) ideas on how to implement such changes.
- Providing educational courses and activities enriched thanks to new knowledge gained from RESOLVE.
- Assessing job placement in order to evaluate if updating of educational programs had a positive impact on students' careers.
- Sharing the results among University's members as a process of continuous improvement.

7.2. Exploitation of strategic learning in educational programs

In reference to teaching, strategic learning may be exploited restructuring teaching programs, e.g. completing the educational path of students (belonging to Science, Technology, Engineering and Mathematics and Management fields), including new courses or new issues in existing courses already held, new case studies developed thanks to results from RESOLVE. Hence the teaching activity will allow the individual strategic learning obtained by university members participating to the Resolve to become organizational by means of the updating of documents for existing courses taught. Doing so, this dissemination of new knowledge acquired allows training professional figures required by OEMs and other automotive industry firms, who will be able to support them in developing, designing and then make marketable L-category vehicles, such as D1 and D2. Table 12 shows in detail strategic learning in educational programs for each University involved in RESOLVE project.

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Table 12 - Exploitation of strategic learning in educational programs

How the strategic learning is exploited / **Which University will exploit the strategic learning**	***New taught courses or new issues in existing courses taught useful to complete educational path of students.***			***New case studies developed through using RESOLVE project published data.***			***Other potential improvements***		
	(1) Expected outcomes reported in the exploitation plan delivered at beginning of the project	*(2)Outcomes realized during the project*	*(3)Potential outcomes expected after the end of the project*	*(4)Expected outcomes reported in the exploitation plan delivered at beginning of the project*	*(5)Outcomes realized during the project*	*(6)Potential outcomes expected after the end of the project*	*(7)Expected outcomes reported in the exploitation plan delivered at beginning of the project*	*(8)Outcomes realized during the project*	*(9)Potential outcomes expected after the end of the project*
The University Of Warwick (WMG)	Develop some academic modules in the area of vehicle dynamics and vehicle electrification. Develop new taught courses for both Undergraduate and Postgraduate Degrees to deliver multi-disciplinary knowledge for students.	New MSc Sustainable Automotive Engineering (SAE) initiated by James Marco at WMG. Course launched in October 2016, with a cohort of 15 students. October 2017 cohort of 15 students. With modules in Automotive Hybridisation and electrification, Energy Storage and High Voltage Systems for HEV Applications, Propulsion Technology for HEV	This MSc SAE course is ongoing and the predicted cohort of students for 2018-19 is 30. The Undergraduate module is predicted to have a cohort of 60 students for 2018-19.	Case-studies to use in WMG Academies for Young Engineers, which is part of the Government-backed initiative for University Technical Colleges for 14-18 year olds.	Research has fed into teaching Modules at undergraduate and Masters level on Simulation, energy storage and vehicle systems.	Outcomes planned in column (4) are confirmed.	Promoting best practice and sharing knowledge with our post-graduate Formula Student team. Develop research expertise to supervise new Doctor of Philosophy and Engineering Doctorate (International) degrees	Prof Dave Greenwood is the academic lead for the WMG Formula Student team. Currently one-student researching control systems for an Engineering Doctorate Degree.	The WMG Formula Student Team is an ongoing programme. One new Doctor of Philosophy candidate is expected to start research into control systems in the 2018-19 academic year.

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		Applications, Systems Modelling and Simulation. For the B Eng Applied Engineering undergraduate degree. A new module has been launched in 2017 titled: Sustainable Energy Systems. Cohort of 60 students for 2017.							
Ceske Vysoke Uceni Technicke V Praze (CTU)	Enlargement of existing passive and active safety to motorcycles, electric vehicles and new types of mobility means.			New students projects and problem-oriented final thesis.			Ph.D. study aimed to the intelligent vehicles include the motorcycles and electrical vehicles.		
University of Pisa - Department of Civil and Industrial Engineering (UNIPI-DICI)	Contributions in some academic courses in the area o vehicle dynamics and vehicle design for students of the Master Laurea courses.	During the course of "Automotive Design", in the MsC in Automotive Engineering, the double-track model of tilting vehicles was discussed and the main similarities and differences were highlighted with respect to conventional bikes and cars.	Outcomes planned in column (1) are confirmed.	Case studies to be used in taught courses	The 4-wheeler tilting mechanism has been shown in the course of "Automotive Design" in the MsC in Mechanical Engineering.	Outcomes planned in column (1) are confirmed.	Promoting best practice and sharing knowledge in the framework of master theses and with our Formula Student team. Develop research expertise to supervise master theses or PhDs students dealing with vehicle dynamics and vehicle design	Six MsC theses were discussed concerning 4-wheeler dynamics and structural properties.	Outcomes planned in column (7) are confirmed.
University of Pisa - Department of Economics and Management (UNIPI - DEM)	Develop some topics within Cost Management area about early stages of New Product Development (NPD) and Cost Driver Management.	Within the Cost Management Course held by Prof. Riccardo Giannetti, in the Academic Year 2016-2017 it had been analyzed the relevance of cost driver management	Outcomes planned in column (1) are confirmed, furthermore within Cost management course held by Prof. Riccardo Giannetti it will be developed the	Case studies to use in Cost Management courses and in Postgraduate Courses.	On May 10th 2017 at Unipi (DEM has been held a seminar on the cost management initiatives within Resolve project,	Outcomes planned in column (4) are confirmed	Promote best practice and sharing knowledge with our post-graduate Develop research expertise to supervise PhD students Formula Student team.	Nothing to mention	Outcomes planned in column (7) are confirmed

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		during the new product development	issue concerning the business model innovation as possible way to enhance electric vehicles sales						
University of Florence (UNIFI)	Update of existing courses related to vehicle design through the know-how acquired within the project. Modelling and simulation activities to be introduced within CAE-related courses.	The competencies related to electric – L – vehicles have been cited and described in occasion of courses related to vehicle design, such as: "Complementi di costruzione di veicoli stradali" ("Road vehicle design"Prof. Marco Pierini and Phd.Ing. Lorenzo Berzi), Academic Years 2015-2016, 2016-2017, and "Costruzione di veicoli elettrici ed ibridi" ("Design of electric and hybrid electric vehicles", PhD.Ing. Lorenzo Berzi), Academic Years 2017-2018.	Outcomes planned in column (1) are confirmed.	Availability of data for students' activities (mainly master thesis ones) with various levels of detail: course-related exercises, course-related projects, new thesis development.	Within didactic activities, the data obtained through the knowledge of the case study of the RESOLVE vehicle have been directly used in occasion of 2 bachelor degree thesis (degree date: 07/07/2016; 03/10/2016) and 1 master degree thesis(degree date: 14/04/2016).	Outcomes planned in column (4) are confirmed	Proposal of seminars for students/generic public. In-depth studies to be proposed as PhD activities. Expertise for researchers to improve supervising capabilities.	A partial follow-up of RESOLVE project has been the prosecution of the studies related to electric vehicle battery crash as a topic of interest for PhD studies (and in particular one started at UNIFI on 01/11/2017).	Outcomes planned in column (7) are confirmed

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In summary universities wil exploit learning coming from RESOLVE by:

- updating their existing taught courses with new knowledge acquired through RESOLVE project ;
- developing case studies to be used both in taught courses both in students' thesis at several levels ;
- developing research expertise to be applied in PhD activities;
- sharing acquired knowledge with scientific community.

7.3. Strategic learning in research and consulting activities

In reference to research activities, Universities exploit the results gained from the RESOLVE project in terms of strategic learning, producing new knowledge and performing new researches, which will be shared with the academic community and with managers and experts through conferences/workshops. Further new knowledge gained from RESOLVE may provide insights for researches in new fields, or new insights for researches in existing fields. Therefore, usefulness of increased knowledge is twofold: on one hand it helps in advancing research in L-category vehicle issues, such as D1 and D2; on the other hand it allows the applications of new findings in automotive industries, supporting them in designing, developing and selling vehicles as D1 and D2.

Last, but not least, the RESOLVE project impacts on technology transfer, the so-called third mission of Universities. Universities are increasingly seen as one of the engines of economic growth and are being asked to contribute to economic development and competitiveness (Feller, 1990). The project results may be exploited to develop a knowledge technology transfer from university to industries, for example through supporting innovative and technology-oriented SMEs, start-up and spin-off companies. Therefore, RESOLVE project allows also the development of relationship among Universities, such as research cooperation, and with Industry partners, such as collaboration in consulting and R&D activities, both with Consortium partners after the end of RESOLVE project and with wider automotive industry on vehicle light-weighting, through exploitation of experience and knowledge gained from RESOLVE. This improvement of the KIBS' "relational capital"[11] represents another potential element promoting the further development of learning produced by the Resolve project.

Also, within the so-called "Other KIBS" organizations, results from the RESOLVE project may helpful, in terms of strategic learning, to individual members in acquiring new knowledge. This new knowledge should be explicitly embedded in organizational activities. Doing so, increased know-how gained form RESOLVE may become useful to KIBS to respond to OEMs and other automotive firms' needs, providing consulting services and creating research collaborations to support in designing, developing and making marketable L-category vehicles, such as D1 and D2.

Table 13 shows in detail strategic learning items in terms of increased knowledge and advancements in research areas for Universities and Other KIBS organizations.

[11] Relational Capital refers refers to the company's portfolio of customers (generally known as "goodwill") and its relationships with suppliers, banks, and shareholders, its cooperation agreements and alliances (strategic, technological, production, and marketing), its commercial brands, and its image (Sveiby, 1997). In this context we mainly refer to relational capital, the set of relationships and interconnections that each organization engages with external parties.

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Table 13 - Strategic learning regarding research and consulting activities.

Type of strategic learning / University and other Knowledge Intensive Business Service organizations (KIBS)	New knowledge		New research (in existing areas or in new areas)		
	(1) New knowledge expected at beginning of the project (reported in the exploitation plan delivered at beginning of the project)	*(2) New knowledge acquired during the project*	*(3) New research expected at beginning of the project (reported in the exploitation plan delivered at beginning of the project)*	*(4) New research realized during the project*	*(5) Potential new research expected after the end of the project*
Austrian Institute of Technology Gmbh (AIT)	New knowledge regarding Beyond-State-of-the-Art on powertrain cost evaluation and realization on energy efficiency (through regenerative braking and light weighting), vehicle driving dynamics (stability and safety), and passenger wellbeing for all L-category vehicle classes.	Knowledge regarding the cost evaluation and realization of energy efficient vehicles using electric and mechanical multibody simulation was acquired and intensified in the course of the project.	New research areas like human comfort and thermal perception modelling will be established (cp. passenger wellbeing).	New research regarding Multibody simulation and passenger wellbeing was realized and developed during the course of the project	Potential new research includes the development of more sophisticated passenger comfort models and vehicle cabin air flow and temperature distribution simulations
Ricardo Deutschland Gmbh (RICARDO)	New knowledge about modelling of regenerative braking systems in 1D longitudinal environment.	Knowledge on defining the right sizing of components of an electric powertrain. Optimization of transmission ratio for best efficiency. Prediction of performance and energy consumption.	Analysis of factors affecting the electric powertrain efficiency in a global sense – from choice of components to technical specifications and drive cycles	Sweep studies to analyze the influence of several factors on energy consumption. Optimization of cooling of critical powertrain components. Selection of components for cost effective powertrain design.	
Re:Lab S.r.l (RELAB)	New knowledge in the development of dashboard and HMI systems for the ELVs. By performing iterative usability bench-test, the HMI concepts will be validated to be compliant with the usability requirements, the efficiency and effectiveness and the user acceptance, in order to be able to	During the project RELAB acquired new awareness of its role in the RESOLVE innovation ecosystem, using the HMI as a mean to exploit the potential of vehicles designed in the project and as an enabler of the acceptance of ELVs on the market. The knowledge and the experience acquired during the project will be applied in commercial projects concerning the design and implementation of HMI for electric vehicles.	In order to foster the development and deployment of mass-market ELV, will research how to design an innovative Human Machine Interface for ELVs, aimed at improving the rider's comfort and at enhancing the acceptability of ELVs that actually address the real needs of the OEM's user target. The vehicle digital dashboard will integrate a new set of	Promoting best practice and sharing knowledge in seminars and workshops, with RE:Lab personnel and with larger public. Increase expertise and knowledge in designing,	*New research expected at beginning of the project (column n. 3) are confirmed*

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	actually address the needs of the OEMs in the ELV domain.		information needed for ELVs (e.g. the overall range estimation), and it will include ad-hoc controls enabling the rider to have a safer, highly ergonomic and effective interaction with the vehicle.	integrating into a vehicle and testing HMI for ELVs. 2016 - C. Calefato; L. Guidotti; E. Landini; R. Montanari; F. Tesauri, "Challenges and opportunities in the HMI design for EV", ITS16 European Congress, Glasgow - June 6 - 9, 2016 2016 – L. Berzi, C. Calefato; S. Fruttaldo; E. Landini; R. Montanari; L. Berzi; M. Delogu, Marco Pierini, 2Understanding the User Needs in the Electric Mobility System: a Survey Study", uropean Conference on Human Centred Design for ITS - Loughborough UK, June 30 - July 1 2016	
Kiska Gmbh (KISKA)	New knowledge regarding design and development of innovative concepts in terms of packaging, layouts and ergonomics that leads to efficient, lightweight solutions also looking exciting and desirable.	The goal was to design a vehicle which should not have looked too big to have a massive presence in the traffic, nor too small to not give confidence nor protection to its passengers. To stay as light as possible, the number of elements has been reduced thanks to the fact that those elements shared technical and aesthetical functionalities.	New researches dealing with ergonomic issues, definition of vehicle layouts and basic technical components.	To create such a vehicle has been an opportunity to develop new solutions to ease ingress for both passengers, and to experiment them not only on a static model, but on a working demonstrator.	New research expected at beginning of the project are confirmed
Idiada Automotive Technology Sa (IDIADA)	New knowledge regarding tilting vehicles suspension design and chassis control systems strategies New knowledge about two-wheelers acceptability analysis	How to test and recognize suspensions for two-wheelers in Compliance tests (K&C). How to test, analyze and evaluate the acceptability of two-wheelers vehicles.	New research in beyond-state-of-the-art powertrain validation New research in the application of testing methodologies for tilting vehicles New research in regenerative braking strategies for electric vehicles New research in smart range assistant systems		Capabilities for regenerative braking calibration, strategies and model design with Simulink have been strengthen and extended thank to the RESOLVE project.
WMG	New knowledge on control functions development for smart range management with the human-machine interface to reduce range anxiety of Electric Vehicle driver.	'Modelling and Simulations of a Narrow Track Tilting Vehicle', JJ Chong, J. Marco, D. Greenwood, Exchanges: the Warwick Research Journal, Vol 4, No 1 (2016). 'Nonlinearity Compensation based Tilting Controller for Electric Narrow Tilting Vehicles', presentation by Yaxing Ren, 2018 5th international Conference on Control, Decision and Information	New research areas like self-learning vehicle that leverages the machine learning techniques to study the driver behavior and offer 'smart assistant' services to support the driver.	Energy Journal paper planned: 'Hybrid Electric Marine Vessel Review and Energy Management Development', Truong Quang Dinh, Truong Minh Ngoc Bui, Yaxing Ren, James Marco, Watts Chris	New research areas like self-learning vehicle that leverages the machine learning techniques to study the driver behavior and offer 'smart assistant' services to support the driver.

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		technologies CoDIT2018 'Torque Vectoring based Robust Drive Assistance for Turning an Electric Narrow Tilting Vehicle', Yaxing Ren, Truong Quang Dinh, James marco, Dave Greenwood, 44th Annual Conference of the IEEE Industrial Electronics Society, IECON 2018			
CTU	Improving knowledge in the field of ergonomy, vehicle theory, electric drivetrain.				
UNIPI (DICI)	New knowledge regarding dynamics of novel vehicle architectures (4 wheeler tilting vehicles) and vehicle design. New knowledge on active safety system applied to motorcycles.	Capability of longitudinal forces at rear-wheel to affect the vehicle roll.	New research on vehicle design and on vehicle dynamics and control.	Bucchi, F., Cerù, F., & Frendo, F. (2017). Stability analysis of a novel four-wheeled motorcycle in straight running. Meccanica, 52(11-12), 2603-2613. F. Bucchi, F. Bucchi, D. Simic, O. Di Tanna, M. Perterer Design of novel tilting electric four-wheelers. 11th International Motorcycle Conference, IFZ, 2016. F. Bucchi, F. Frendo, A. Vestri. simulazione multibody di un veicolo basculante a 4 ruote. 46o Convegno Nazionale AIAS, 2017. F. Bucchi, F. Cerù, F. Frendo. Analisi dinamica di veicoli basculanti a tre ruote. 44o Convegno Nazionale AIAS, 2015	The topic of torque-vectoring for tilting four wheeler is a challenging study which could be furtherly developed.
UNIPI (DEM)	New knowledge regarding: 1) Cost Management in early stages of new product development; 2) Cost driver Management and Cost reduction initiatives (e.g. Modularity scalability; functional integration; existing low-cost solutions)	How to set the sophistication of cost analysis according to novelty degree of the product under development	New insights in research areas as Cost Management in early stages of NPD, Cost driver Management	2017 - Giannetti R., Dello Sbarba A., Lanzara R., Yacoub B. "Managing costs through business model servitization: a strategic management accounting perspective on the RESOLVE project", abstract presented at the Global Conference on Services Management. International School of Advanced Education campus - Volterra, Italy – Oct 3-7, 2017 proceedings conference ISSN 2372-5885.	Through the RESOLVE project we have had the idea to start to investigate (in future research) the role of management accounting in temporary organizations established to manage the partnership between OEMs and knowledge intensive business service organizations (KIBS).Furthermore the support of strategic management accounting in electric vehicles business model design is another topic

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				2016 - Giannetti R., Lanzara R., Risso L. "Managing cost drivers: the case of RESOLVE project", paper presented at MAR 2016 - Manufacturing Accounting Research Conference, Lisbon, Portugal, June 15-17, EIASM (European Institute for Advanced Studies in Management), pp. 1-19, ISSN 2295-1709.	which could be furtherly developed.
UNIFI	New knowledge regarding vehicle component state-of-the-art technology, cost assessment methodologies, energy management strategies and integration between vehicle hardware and software.	UNIFI confirms that RESOLVE project has been an opportunity to improve knowledge regarding: - Vehicle components, due to the participation to battery verification phase using simulation tools - Energy management, due to the execution of simulation for consumption estimation - Integration between hardware and software, in particular due the study of the HMI system	Suggestions for new research in technical areas, especially in relation to vehicle dynamics, design for ergonomics, design for energy efficiency. Suggestion for in-depth analysis in relation to non-technical areas, such as identification of users' needs, riders acceptance and product targeting.	The expected objectives have been obtained and, in particular, RESOLVE has been an impulse for the development of the cited topics.	We confirm objectives described in column 3. In particular, new studies related to tilting vehicle dynamics are ongoing. Early activity: G. Savino, L. Berzi, M. Pierini (2017). Studio di fattibilità per un simulatore motociclistico con controllo allo sterzo semplificato. In: Archivio AIAS. Associazione Italiana per l'Analisi delle Sollecitazioni (Feasibility study for a motorcycle simulator adopting a simplified steering control)

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Summarizing, organizations involved in the project through performing its role and related activities within the project:

- acquired new knowledge regarding its existing core business (e.g. about braking systems, HMI, control functions development, dynamics of novel vehicle architectures and vehicle design, Cost Management in early stages of NPD, and so on);
- realized many researches;
- will develop new researches in existing or new areas thanks to the insights provided by new knowledge

Finally Table 14 shows in detail impacts of project results on KIBS relational capital. Per line there are organizations and per column the partners involved in the development of new relationships; in the cross between lines and columns there is the aim of the relationship.

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Table 14 - Impact of project results on KIBS relational capital

Relationship with: / KIBS organizations and aim of relationship	Other Universities			OEMs			SMEs			Others		
	1)Expected outcomes reported in the exploitation plan at beginning of the project	*2)Outcomes realized during the project*	*3)Potential outcomes expected after the end of the project*	*4)Expected outcomes reported in the exploitation plan at beginning of the project*	*5)Outcomes realized during the project*	*6)Potential outcomes expected after the end of the project*	*7)Expected outcomes reported in the exploitation plan at beginning of the project*	*8)Outcomes realized during the project*	*9)Potential outcomes expected after the end of the project*	*10)Expected outcomes reported in the exploitation plan at beginning of the project*	*11)Outcomes realized during the project*	*12)Potential outcomes expected after the end of the project*
AIT	Dissemination to increase academic reputation and to evoke research cooperation with other Universities which offer complementary knowledge. Exploitation of developed know-how and offering scientific results in training courses.	Cooperation with in the project involved partners was intensified. Publications with University-partners have been published.	Follow-up project proposals have been submitted with OEMs and other companies from the automotive industry sector, as well as scientific and SME partners.	Consulting and R&D activities with wider automotive industry on vehicle light-weighting	Research activities and customer projects could be acquired with companies from the automotive industry	Follow-up project proposals have been submitted with OEMs and other companies from the automotive industry sector, as well as scientific and SME partners.	Providing tailor-made solutions in one stop shops.	Full electric-drive train development solutions were offered to SME partners and projects were started.	Follow-up project proposals have been submitted with OEMs and other companies from the automotive industry sector, as well as scientific and SME partners.	Public media to share the gained RESOLVE outcomes to broad public and stakeholders.	Publications have been written to share the outcomes of the project with the broad public	The potential outcomes reported in column (10) are confirmed
RICARDO	To initiate and maintain a healthy role of facilitating academic research and providing university students an opportunity to experience industrial	Very good collaboration with OEMs, universities and Tier 1 suppliers. Coordination of an important work package within an international challenging project.	Creation of a network of contacts for potential future projects.	Having a long-lasting relation of development of technologies and products covering electric powertrains.	Collaboration with all the partners for the creation of an electric powertrain at the latest status of the art	Useful know how for future challenging projects	Development of technically challenging projects for the OEMs					

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	research opportunities.											
RELAB	New relationships with Economics and Management University (e.g. UNIPI) to identify new business development strategy in order to acquire new market shares and strengthen the position of RELAB in the ELV market (as a supplier of OEM as well as Tier1 suppliers).	Thanks to the knowledge gained in the project, RELAB created a strong relationship with universities and other research entities on the themes of design, implementation and evaluation of the HMI.	Potential outcomes reported in column (1) are confirmed	New collaboration to acquire new market shares and strengthen the position of RELAB as Tier 1 supplier (for the HMI).	Through the experience gained in the project, RELAB reinforced the position in relation to the OEMs, defining RELAB as a high-knowledge partner and strengthening the potential market share	Potential outcomes reported in column (4) are confirmed	Creation of new partnerships with complementary partners (e.g. HW manufacturer) to embed the HMI technology in the vehicle instead of providing only a consultancy on the HMI concept.	RELAB has created relations with other SMEs in the consortium in order to exploit the complementarity emerged during the project in other research and commercial projects	Potential outcomes reported in column n (7) are confirmed	Collaboration with great Telecommunication companies to provide additional services and features included in the HMI system (e.g. connectivity).	RELAB realized connectivity systems able to increase the impact of telecommunication companies and to exploit the technology to open new market potential.	Potential outcomes reported in column (10) are confirmed
KISKA	New relationships with Universities for developing innovative projects in the mobility field dealing with e.g. ergonomics, design and development of prototypes. .		We confirm the potential outcomes reported in column (1)	Consulting and development contracts from LV industry, mainly on packaging, creating layouts and testing ergonomics, producing several prototypes, technical demonstrators and show models of bicycles,		High potential to get in touch with OEMs: the sector of light urban mobility is booming worldwide, and the expertise gained on the RESOLVE project could drag interest to these OEMs to consult KISKA on coming 2-/3-wheeler projects.	Creation of new partnerships with complementary partners (e.g. other SMEs suppliers within automotive industry) supporting them in design new prototypes of ELVs (and ICE LVs).		High potential to get in touch with SMEs: suppliers the sector of light urban mobility is booming worldwide, and the expertise gained on the RESOLVE project could drag interest	Creation of new partnerships with organizations of other sectors about activities as brand co-creation, communication and consulting.		High potential to get in touch with such organizations: light urban mobility is booming worldwide, and the expertise gained on the RESOLVE project could drag interest to these companies to consult

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				scooters, motorbikes, 3-wheelers and automobiles					to these OEMs to consult KISKA on coming ELVs and ICE LV projects.			KISKA on coming branding projects.
IDIADA	Participation in Technical Congresses through papers and technical seminars		Potential outcomes in column (1) are confirmed.	Consulting and development contracts from LV industry, mainly on simulation, testing and engineering in the fields of stability control, regenerative braking, energy efficiency and range estimation.		Potential outcomes in column (4) are confirmed. Furthermore,the project gave the opportunity to develop relationships with OEMs, SMEs and universities within motorsport field.	Providing comprehensive and cost effective development services to SMEs in the two-wheeler sector.		potential outcomes in column (7) are confirmed.	Supporting dissemination to the general public for the introduction of electric vehicles and state-of-the-art tilting vehicles.		Potential outcomes in column (10) are confirmed
UNIPI (DICI)	Dissemination to increase academic reputation and to evoke research cooperation with other Universities, which offer complementary knowledge.	Through the project we have had the opportunity to enforce relationships with UNIFI and UNIPI (DEM) within the University Center for Automotive and Mobility Research (UCAR) "Corradino d'Ascanio". Moreover we activated relationship with all the partners, particularly with those (Piaggio, KTM, AIT, Idiada, University of	Potential outcomes reported in column (1) are confirmed	Consulting and R&D activities with automotive industries	The expertise on vehicle simulation extended in the project was applied to some R&D activities with usua partners companies.	Potential outcomes in column (4) are confirmed	Consulting and R&D activities	Nothing to mention	We confirm the potential outcomes in column (4). Furthermore, the project given the opportunity to develop relationships with SMEs operating within motorsport field	Dissemination to share the gained RESOLVE outcomes to scientific community and also to broad public and stakeholders.	The models developed in the project were presented in academic conferences (e.g. AIAS), academic-industrial conferences (e.g. IMZ) and software developers' conferences (e.g. MSC Users' Conference).	Potential outcomes reported in column (9) are confirmed.

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		Warwick) involved in the WPs where we worked										
UNIPI (DEM)	Creation of new opportunities for research collaboration with other Universities in Engineering fields and Management fields.	Through the project we have had the opportunity to enforce relationships with UNIFI and UNIPI (DICI) within the University Center for Automotive and Mobility Research (UCAR) "Corradino d'Ascanio". Moreover we activated relationship with all the partners, particularly with those (Piaggio, KTM, Relab) involved in the WPs where we worked	Potential outcomes reported in column (1) are confirmed	Consulting and cooperation in research activities with automotive industries.		Potential outcomes in column (4) are confirmed	Consulting and cooperation in research activities with SMEs in automotive sector.		We confirm the potential outcomes in column (4). Furthermore, the project given the opportunity to develop relationships with SMEs operating within motorsport field	Collaboration with other organizations involved in sustainable mobility actions, in order to support them in cost management Dissemination of increased knowledge with academic community.		Potential outcomes in column (9) are confirmed. Furthermore the project given the opportunity to develop relationships with associations of SMEs operating within the motorsport field
UNIFI	Dissemination of new data, methods and results through scientific publications and conferences, improving possibilities for cooperation and knowledge exchange both at national and international level.	In addition to the improvement of the relation with national and international partners, a few articles have been prepared and published or presented at conferences.	We confirm the potential outcome reported in column (1)	Creation of new opportunities for collaboration activities, both at "private level" (University-OEM directly) and "joint research" activities (participation to Research Consortiums).	Nothing to mention	We confirm the potential outcome reported in column (4).	Creation of new opportunities for collaboration activities, including joint R&D activities (participation to Research Consortiums) and know-how transfer from Academic partners to SMEs.	UNIFI is collaborating with various partners involved in RESOLVE to develop new project proposal.	We confirm the potential outcome reported in column (4).	Collaboration with relevant non-technical partners related to mobility issues, such as Municipalities, fleet managers, mobility managers. Sustainable mobility actions proposal to potential users, especially promoting activities related to safe driving and behaviors,	Thanks to RESOLVE, the collaboration with Florence municipality has been consolidated.	We confirm the potential outcome reported in column (10).

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										environmental consciousness, efficiency improvement.		
WMG	Build partnerships and maintain connections with other Universities.	During the project we have had the opportunity to work with UNIPI & UNIFI.	Potential outcomes reported in column (1) are confirmed	Support and help the OEMs to increase their competitiveness by developing innovative technologies and technology transfer to the industrial partners.	During the project we have supported PIAGGIO & KTM.	Potential outcomes reported in column (4) are confirmed	Support SMEs to exploit new market opportunities and gain a competitive advantage by creating the research-led tools and techniques, building sustainable and collaborative relationships.	Research has underpinned our capabilities that have led to discussions with local UK SME's	We confirm the potential outcomes reported in column (7).	Awareness raising by diffuse RESOLVE activities and outcomes on press or public media to a wide range of stakeholders including the general public.	Raised awareness of the RESOLVE project on the WMG public web site and social media accounts.	Potential outcomes reported in column (10) are confirmed
CTU	Cooperation with other universities in the field of their projects (COST, Marie Curie, etc.)						New inputs for cooperation with SME aimed to simulations and mathematical modelling					

In summary, Universities (WMG, CTU, UNIFI, UNIPI DICI, UNIPI DEM) through RESOLVE project:

- developed and enforced relationships with other universities, both belonging to he same or different fields,in order to perform joint research activities regarding topics of the project and to build partnership to be exploited in the next future.
- created collaboration with OEMs, suppliers and SMEs of automotive sector in order to support them in R&D activities and to transfer them their know how.

Other KIBS organizations:

- developed relationship with universities, in order to collaborate in research and consulting activities and to share knowledge with them.
- created collaboration with OEMs, suppliers and SMEs of automotive sector in order to support them through consulting and R&D activities.

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Concluding remarks

As outlined in the present document, the objective of the project was designing and developing new innovative light vehicle concepts that could actually increase the attractiveness of Electric L-category Vehicles (ELVs) and be turned into mass-market products.

The relevance of RESOLVE project outcomes may be examined from two perspectives: (1) market exploitation, and (2) strategic learning.

The first perspective concerns technological advances introduced by the project and the efforts done to meet customer needs. In fact, the project developed a range of modular and scalable electric powertrains and battery architectures, aiming to reduce significantly end-user ELVs cost, and, consequently, increasing the potential market share of these vehicles. The project also generated a number of technological advances towards maximizing energy efficiency of ELVs (such as regenerative braking and lightweight design), and improving ELV rider experience (such as vehicle stability and handling, advanced human machine interface (HMI), comfort and weather protection). Such advances have been shown through three tilting four-wheelers ELV concepts. In virtue of the potential marketability of the new products that can be developed starting from the results of the project, the main beneficiaries of these advances are OEMs.

Therefore, positive forces to increase the relevance (and the possibility of success) of RESOLVE, may be:

- the strength of brand image of two OEMs as consolidated firms;
- the existence of wide networks in terms of cooperation and synergies with car and motorcycle manufacturers;
- the opportunity to attract new customer segments and to acquire new knowledge.

On the other hand, marketability of the demonstrators developed within the project have to face several difficulties entailed by the dynamic, uncertain and complex electro mobility scenario: (i) the high level of technological and market uncertainty; (ii) the high costs (manufacturing costs, purchasing costs and Total Cost of Ownership); (iii) end-users expectations, in terms of safety and performance.

Nowadays, the market and demand for pure electric L-vehicles is still relatively small-scale, notwithstanding the policy measures to push for wide spreading environmental friendly and sustainable modes of transport adopted especially in larger cities. However, it is likely users will accept to shift to such alternatives in the coming years if these represent cost-effective solutions for their mobility needs.

The primary RESOLVE outputs will consist in developing solutions to overcome factors currently limiting the adoption of ELVs hence cost, energy efficiency, attractiveness and willingness to use ELVs, to name a few.

Alternative marketing strategies as well as related Business Models have been analyzed and it seems that innovation of business model can contribute to the ELVs diffusion. The BM design could also have significant impact both on purchase cost and on Total Cost of Ownership (TCO) for end users. Formulas other than direct selling could provide a competitive TCO for ELV compared to conventional scooters. Accordingly, customers could gain cost-savings through lower acquisition and utilization costs. These formulas have to be taken into account jointly with product development strategies, since both contribute in determining actual costs and possible levers for costs reduction.

Business model innovation is useful also do reduce/eliminate the gap between the price that end user are available to pay for vehicle similar to D1 and D2 demonstrators and the acceptable price for OEMs. A questionnaire that was submitted within the project to a panel of potential users in order to investigate the “willingness to pay” of potential customers, shown that the 90% of all interviewees is not willing to pay more than € 7.420,00 for vehicles similar to D1 Demonstrator and no more than € 9.220 for vehicles similar to D2. Different factors can contribute to reduce the gap among prices used in this report when has been estimated the TCO for end users according to the OEMs perspective and prices representing the willingness to pay. One lever could be business model innovation and/or a further exploitation of technical solutions developed during the project as in the case of D3 demonstrator.

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Furthermore, it worth to say that the D1 Demonstrator total cost of ownership (TCO) represented in Table 7 is significantly higher than that estimated for a similar ICE scooter, above all for the D1 Demonstrator highest estimated selling price. However, RESOLVE project is mainly aimed at promoting a new eco-sustainable and safer mobility, so it is opportune to think about non-conventional formulas in order to wide spread such innovative proposals (i.e. electric multi-wheels tilting vehicles). Hence the higher D1 Demonstrator TCO should be counterbalanced by the D1 Demonstrator peculiarities, because consumers should accept to pay more because they will obtain more than buying a conventional two wheels scooter, in terms of safety, style, weather protection, cargo capacity. It is important to underline that the differences between D1 Demonstrator and conventional ICE two wheels scooters are not deriving only from powertrain (electric vs ICE) but also from the vehicle design (e.g. numbers of wheels, style, easy to use, etc). Powertrain and vehicle design are both cost and value drivers, that is they are influencing the production cost and consequently the acceptable selling price for the OEM, but they are also (potentially) adding value to the product, determining the end user willingness to pay (through the perceived safety, riding pleasure and so on). Hence, due to the major value embedded within the D1 Demonstrator vehicle concept respect to conventional ICE scooters, the barrier represented by the higher TCO could be mitigated, through an effective communication of D1 Demonstrator vehicle and powertrain characteristics. In this way it will emerge that the higher D1 Demonstrator TCO doesn't depend only by its electric powertrain, but it is justified also by the vehicle dynamic behaviour, style and brand.

The second perspective of the exploitation plan refers to the exploitation of project results in terms of strategic learning and relational capital for Knowledge Intensive Business Services (KIBS) organizations (Universities and other service firms) and manufacturing companies (OEMs and suppliers) involved in the project. As to teaching activities within Universities, the additional know how gained through the project might be reinvested in training professional figures who are able to design, develop and produce L-category vehicles. As to research and consulting activities within Universities and other KIBS organizations through the RESOLVE project, participants can expand their knowledge in existing research areas or acquire know—how in new fields. Further, participants will be able to exploit this knowledge development by collaborating with other KIBS, OEMs and industry partners working towards project results and consolidating foundations for development of future opportunities of collaboration. Hence, strategic learning gained by KIBS could in the long run act as "multiplier" of the main project results.

As overall conclusions, Dissemination, Communication and Exploitation have been massively pursued all along the RESOLVE project.

The main Communication work is evident from the website, the newsletter, the video, the leaflet, press and articles published on RESOLVE.

Dissemination activities have included the active participation to workshops, trade shows, conferences and events, several scientific publications, students' thesis, and public deliverables.

Exploitation has been carried out with the same commitment, even from different perspectives by industrial partners, SMEs and KIBS. Tangible results achieved in the project allow them to improve their competitiveness, increase their knowledge and give new feed to the debate on Electro-Mobility.

Especially in the last part of the project life, Dissemination, Communication and Exploitation activities have found continuous synergies and have fed each other, in a common perspective of valorize RESOLVE results, spread them in order to foster the debate on how to make electric vehicles and in particular light electric vehicles a viable alternative to ICE vehicles and to re-use such results towards better and better solutions.

RESOLVE offers multiple contributions to overcoming barriers to the use of electric vehicles in urban context: not only technical solutions, but different business models that take into account the complexity of user needs and his/her propensity to purchase and willingness to pay.

Dissemination and exploitation of the RESOLVE results will continue also after the official end of the project.

A final press release has been published after the final event and different articles on the project and its final event have been published and are in progress.

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Moreover, each partner will carry on internal communication and exploitation activities towards their customers.

Liaison activities are going on with other GV projects (e.g. final event of SILVERSTREAM).Finally, results will be presented at two events in Europe (The future of transport conference and 3rd Conference Automotive 2018)

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