Deliverable Report

Deliverable Title:

First Plan of Use and Dissemination of Results

Deliverable No.	8.10
Deliverable nature	Report
Work Package (WP)	8
Task	8.10
Dissemination level [1]	PU
Number of pages	53
Keywords	Exploitation, IP Protection, Key Results
Authors	Fundacion Eurecat (EUT)
Contributors	All partners
Due date of deliverable	30.11.2022
Actual submission date	30.11.2022

Technical References

Project acronym	SALEMA
Project full title	Substitution of Critical Raw Materials on Aluminium Alloys for electrical vehicles
Call	H2020-SC5-2020-2
Grant number	101003785
Project website	salemaproject.eu
Coordinator	Fundacion Eurecat

[1] PU = Public
PP = Restricted to other programme participants (including the Commission Services)
RE = Restricted to a group specified by the consortium (including the Commission Services)
CO = Confidential, only for members of the consortium (including the Commission Services)

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Document history

Version	Date	Author (Affiliation)	Actions& Approvals
V1	06.10.2022	António Louro (EUT)	First Draft Version
V2	17.11.2022	Marc Arona (EUT)	Second Draft Version
Final	30.11.2022	Hannah Arpke (EUT)	Finalisation

Summary

The following document is the Deliverable 8.10 First Plan of Use and Dissemination of Results (PUDR) of the Salema project, funded by the European Union's Horizon 2020 research and innovation programme under grant agreement Number 101003785.

The SALEMA project will produce novel aluminium alloys with minimalised critical raw material content (silicon and magnesium), integrating scrap metal recycling. The suitability and performance of these new aluminium alloys will be demonstrated through four pilot actions and five demonstrators. The integration of scrap metal recycling is essential to create a sustainable circular economy and it is going to serve as a reliable source for high-quality alloys in the future.

The primary objective of SALEMA is to demonstrate a non-CRM dependent aluminium industrial ecosystem. This is to be accomplished by substituting primary CRMs with alternative and commonly available elements, and with resources embedded in domestic scrap. Involving all steps from alloy design, production and transformation to scrap disposal, SALEMA will demonstrate, by validating and implementing a circular economy model, the feasibility of the proposed solutions in one of Europe's crucial economy sectors: the automotive industry at large and the electric vehicle (EV) in particular.

This Plan consists of gathering of all the information related to the preliminary data collected regarding with commercialization, exploitation, IP Protection and identification of Key Exploitable Results within the SALEMA project. Its goal is to introduce the necessary steps to increase, maximize and promote the impact of the project once it ends.

This Plan is an internal and confidential document dedicated to members of the SALEMA consortium. It identifies the key exploitable results and the methodology that will be implemented to achieve the objectives whilst gathering and identifying the IP Protection of each of them in this initial stage of the project.

The definition and steps made towards execution of well-coordinated exploitation and IPR activities (WP8) are aligned with all other tasks developed in the project, as there is a high dependency of the development and research of the technologies with its Impact strategy.

This deliverable constitutes a preliminary exploitation plan. The development of the plan will continue throughout the final year of the project. Together with this report, the full deliverable list of WP8 will have the objective of providing a general overview of the Exploitation/Commercialization of the project and maximize its impact once it concludes. D8.11 Final PER and Exploitation Agreement to be delivered on M36 (April 2024) will be the final version of this document and will conclude with

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an overview of all the Exploitable results, their protection path and any exploitation agreement to be made.

Important to note that D8.6. SALEMA Market study and business modelling frameworks to be presented on M24 (April 2023) will provide an initial analysis of the automotive market and what circular approaches and business models might be present in the future. This will compile all efforts related to the market analysis of the project.

Disclaimer

Abbreviations

Abbreviation / Acronyms	Description
PER	Plan of Exploitation of Results
KER	Key Exploitable Result
EC	European Commission
EU	European Union
GA	Grant Agreement
GDPR	General Data Protection Regulations
IPR	Intellectual Property Rights
PC	Project Consortium
WP	Work Package

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1. Introduction

The success of SALEMA and the realisation of its maximum impact will be achieved via the direct exploitation of the main expected results, mainly the novel processes and materials to be applied in the aluminium production and value chain to automotive (and electrical vehicle) industry.

A clear exploitation roadmap (further research, business plans, investments…) are necessary for advancing the TRL of the technologies developed, accelerating future market deployment.

The purpose of this deliverable is to create a business and exploitation plan that will explore the potential for the development and exploitation of the resilience guidelines beyond the life of the SALEMA project, as well as set an strategy to facilitate the exploitation of such results.

SALEMA envisaged exploitation routes may include a wide range of commercialization options, from efficient technology transfer, direct material commercialisation and immediate integration to ensure a smooth transition from R&D to full industrialisation, value chain integration and market adoption. The continuation of research and cooperation between partners for future opportunities has also been a talking point among the consortium and is the result of the ongoing cooperation and great

All partners involved in the development of new technologies have contributed to it and will continue to be engaged in exploitation and innovation management activities, assessing the re-use potential, commerciality and applicability of the concepts and ideas central to the evolution of the guidelines.

This deliverable aims to:

- Present a preliminary exploitation strategy for the project and provide a holistic overview of the exploitation landscape surrounding it;
- Introduce the methodology for development of exploitation and commercialization throughout the project;
- Serve as a step towards setting out clear and measurable exploitation KPI's, the results of which will be monitored and reviewed regularly;
- Serve as a guidance document for SALEMA Consortium and to stimulate exploitation engagement among partners;
- Ensure that exploitable entities will be utilised in an optimal way and that the desired impact is achieved;
- Outline the IPR protection paths, and foreground plans related to post-project use of the novelties developed during the project and identify their sebsequent ownership;
- Act as a preliminary document that will be developed further in the last year of the project.

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1.1. Methodology

The Exploitation Plan (EP) is designed to maximize the full impact of SALEMA developments and prepare the transition towards market uptake to increase the expected impact of the project. The EP describes the activities undertaken (how and by whom) in order to ensure the exploitation beyond the project itself.

The methodology for creating the final exploitation plan will be the following:

- **Identification and definition of SALEMA exploitable results;**
- **Definition of a IP Protection path for each of them.**
- **Prioritization strategy and singling out the main results of the project;**
- **Development of a market and competitive analysis – presented in the D.8.6 (M24);**
- **Characterization of individual exploitation and business plan for the partners who own the main results;**
- **Definition of possible joint exploitation approaches and cooperation post-project between partners;**
- **Overview of each partner's contribution to the project.**

The objective of this first Exploitation Plan is to get an overview of the current identified exploitable results, prioritize and define the ones that are most important for a successful exploitation and increase the impact of the project for each of the partners, and to establish the initial protection identified by the Consortium.

This deliverable gives some first suggestions, strategies and models to exploit the given results at M19 of the project.

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2. Exploitation

This section explains how SALEMA defines successful exploitation of its results and how this translates into exploitation objectives. This section will also address the parameters of this exploitation plan and the methodology that will be used to arrive at the final exploitation strategy. The document is to be considered preliminary, as it reflects the plans that the partners have at the current stage of the project (M19). A completed and more detailed version will be released at the end of the project, together with the cost analysis and final business strategy.

2.1. Background

In the proposal stage of the project, an initial version of the SALEMA Exploitation table was sent out to each partner so that they could identify their expected results from the project.

At this stage, the partners predicted that 28 results would be developed during the course of the project. These were divided into five categories, that will serve as reference to the developments of Exploitation throughout the project.

Table 1. SALEMA Background Results Category division

Category	Number of results identified
New Methods Developed	10
New Manufacturing Processes	4
New Automotive Parts	10
Industrially Applied ICT Solutions	2
Communication and Dissemination Results	2

When it comes to European funded projects, SALEMA, like so many other projects, will develop an Exploitation strategy to properly maximize the results that are being developed throughout the 3 years of the project. This is not only crucial for the partners, who have to be supported in a more business side to implement the technologies but as well for a wider-scale European impact, prestige and upscale of the technologies, that will enable a stronger cross-border cooperation and strong positioning in the automotive OEM and aluminium producing fields.

In the Grant Agreement, subsection 3 – Rights and Obligations Related to Results, article 28 – Exploitation of Results it can be found:

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ARTICLE 28 — EXPLOITATION OF RESULTS

28.1 Obligation to exploit the results

Each beneficiary must — up to four years after the period set out in Article 3 — take measures aiming to ensure '**exploitation**' of its results (either directly or indirectly, in particular through transfer or licensing; see Article 30) by:

(a) using them in further research activities (outside the action);

(b) developing, creating or marketing a product or process;

(c) creating and providing a service, or

(d) using them in standardisation activities.

Figure 1. Article 28.1 from the SALEMA Grant Agreement

This article claims that the „exploitation" of the results, whatever may be its form – from licensing, to internal use, to service provision or even in standardization, must be guaranteed by the Consortium.

All the actions, strategies and market adoptions proposals that are being carried out (and will be until the project ends) have this major goal in mind.

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2.2. Identification of Exploitable Results

SALEMA Project results have been identified, updated and created and add up to a total of 23 main results and 3 subresult.
The following table is retrieved from a live document that is available for partners to add and update information related to each of the results that they are developing through their technical Work Packages.

2.2.1. New Methods Developed

Table 2. Exploitable Results: New Methods Developed

#	Exploitable result	Description	Value Proposition (competitive advantage, differentiating factors)	Target sectors	IP Protection	Exploitation / Commercial route	Owner	Associated WP (WP/Deliverable)	TRL (beginning/expected)
1	New models to predict mechanical properties of partially recycled aluminium alloys	Empirical models to correlate mechanical properties with amount of impurities and aluminium alloy composition	It does not exist models in the literature for aluminium alloys that take into account the level of impurities	Aluminium alloy producers, HPDC, extruding or stamping manufacturers, research community	Open access solution	Feasibility studies, TRL upscaling	EUT	WP 1 WP 4 WP 5 WP 6	TRL 3/6
2	Know-how about low-CRM alloying systems	Technologically sustainable reduction of CRM in Aluminium alloys	Combining technological and environmental sustainability of Aluminium alloys for automotive	Aluminium alloy producers, HPDC, extruding or stamping manufacturers,	Open access solution	Feasibility studies, data elaboration, TRL upscaling	UNIPD	WP2	TRL 5/7

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				research community					
3	Most optimal metallic yield and melting energy requirement for scrap pre-treatment	Melting the scrap by reducing energy consumption by using the organic component present in the scrap at the end of its life, also avoiding oxidation of the metal (maximum metal yield)	differentiating factors lies in avoiding costly and energy-intensive treatments of pyrolyzation of the scrap	Aluminium alloy producers, scrap specialists, recyclers	Patenting, Trade secret	Follow-up research, feasibility studies, TRL upscaling, consulting, material and equipment sale, licensing	EUT, RAFF, ASAS	WP3	TRL 5/7
4	Extraction of CRM and valuable elements from aluminium dross	Design of a process to recover Critical Raw Materials present in the Al slag, Bi, Si and Mg metal. Optimitzation at lab scale.	There is no mention in the literature related to the recovery of Bi, Si and Mg from Al slags, using a hydrometallurgical process.	Aluminium alloy producers, scrap specialists, recyclers, intra- and entrepreneurs, other industries (heavy transport, railway, naval…)	Trade Secret	Follow-up research, feasibility studies, TRL upscaling, consulting, material and equipment sale, licensing	EUT, RAFF, PROFIL, ASAS	WP3; T3.6; D3.6	TRL 3/4
5	Foundry best practices for structural aluminium parts adopting new alloys	Definition of the High Pressure Die Casting industrial process parameters & product gating design to be	Competitive advantage for EU foundries versus non-EU Suppliers	Automotive & motorcycle OEMs	Trade Secret	Follow-up research, feasibility studies, industrial upscaling, consulting	ENDUR	WP4/ D4.6 D4.10	TRL 3/5

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		adopted with the SALEMA alloys							
6	Al series scraps classification through multi-sensors signatures (3D-XRT-LIBS) on conveyor belts.	Identification of optimal data processing pipeline & software architecture that allows the real-time robotic sorting of Al scraps into several Al series concentrates	Improving the recycling rate of Al scraps inside EU, hence decreasing the need for external supply (primary Al)	Producers and recyclers especially those operating metal shredders and eddy current separators (Zorba generators) More generally any Al scraps collectors may be interested in the technology	Patenting/ Trade Secret	Creation of a company – Spin off	ULIEGE, COMET	WP7/ D7.1 D7.2 D7.3	TRL 5/7
7	Precise control ability on molten metal quality	Quality control of liquid metal with the Prefil®-Footprinter device by filtering and analyzing the inclusions on the filter	Increase in the share and various types of scrap in SALEMA alloys	Aluminium alloy producers, scrap specialists, recyclers, intra- and entrepreneurs, other industries	Trade Secret	Follow-up research, feasibility studies, TRL upscaling, consulting,	IMN	WP1 D1.3 D1.4	TRL 5/6
9	Purification techniques that provide better performance characteristi	Purification of liquid metal from inclusions requires degassing and removing dross	Improvement in the quality of alloys	Aluminium alloy producers, scrap specialists, recyclers, intra- and entrepreneurs, other industries	Trade Secret	Follow-up research, feasibility studies, TRL upscaling, consulting,	IMN	WP6 D6.1	TRL 5/6

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	cs on final product								

2.2.2. New Manufacturing Processes

Table 3. Table 2. Exploitable Results: New Manufacturing Processes

	Exploitable result	Description	Value Proposition (competitive advantage, differentiating factors)	Target sectors	IPR	Exploitation route	Owner	Associated WP (WP/Deliverable)	TRL (beginning/expected)
11	Novel HPDC process for casting the new Al alloys	Design/test/verify and validate casting process parameters when using SALEMA alloys by HPDC process Concepts from melting to casting will be updated: melting&dosing, die cooling¬spraying, vacuum, casting parameters&cycle time, etc.	Sustainable process due to low CRM and recycled alloys. Competitive advantage for thin wall castings with structural properties The result will consist on the parameters setting optimized for each of the SALEMA HPDC alloys developed	EV producers, automotive industry and all value chain and industry	Trade Secret	Feasibility studies, TRL upscaling, spinoff, consulting	FAGOR, ENDUR, EUT	WP 4/ D 4.6 D 4.7 D 4.9 D 4.10 D 4.11	TRL 4/7
12	Novel hot stamping process for	Set up of the process parameters to form aluminium	The result will consist on the parameters setting optimized for each of the	All value chain and industry	Trade Secret	Feasibility studies, TRL upscaling, spinoff, consulting	GESTAMP, EUT	WP 5	TRL 4/7

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	processing the new Al alloys	components by hot stamping process with the new SALEMA aluminium alloys	SALEMA stamping alloys developed Use high recycled content alloys.						
13	Novel cold stamping process for processing the new Al alloys	The actual cold stamping technology will be adjusted in order to stamp SALEMA alloys and guarantee the components integrity and form aluminium components	Decreasing carbon footprint of stamped components production The result will consist on the parameters setting optimized for each of the SALEMA stamping alloys developed	Automotive OEM All value chain and industry	Trade Secret	feasibility studies, industria upscaling	CRF, EUT	WP5 D5.4	TRL 4/7
14	Novel extrusion process for processing the new Al alloys	Set up of the process parameters to form aluminium components by extrusion process with the new SALEMA aluminium alloys	The result will consist on the parameters setting optimized for each of the SALEMA extrusion alloys developed	All value chain and industry	Trade Secret	Feasibility studies, TRL upscaling, spinoff, consulting	ASAS, IMN	WP 6	TRL 4/7

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2.2.3. New Automotive Parts Developed

Table 4. Exploitable Results: New Automotive Parts Developed

#	Exploitable result	Description	Value Proposition (competitive advantage, differentiating factors)	Target sectors	IPR	Exploitation route	Owner	Associated WP (WP/Deliverable)	TRL (beginning/expected)
15	New shock-tower produced with low CRM aluminium alloys	A feasibility of making a current shock tower from Ford in new Salema alloys will be validated	Sustainable process due to low CRM and recicled alloys. Competitive advantage for thin wall castings with structural properties Thin wall casting with no HT or one state HT, suitable for riventing	HPCD, EV producers, automotive industry, other industries (heavy transport, railway, naval, etc.)	Copyright, trademark, Trade Secret	Feasibility studies, TRL upscaling, spinoff	FAGOR, FORD	WP4/ D4.2 D4.9	TRL 4/7
16	New node produced by joining of a HPDC part and an extrusion profile produced with low CRM	Related to the joining: the activity is based on adjusting the actual welding process with the SALEMA alloys while guaranteeing the components integrity. It will be focused on	Reducing carbon footprint of HPDC components production Competitive advantage, first Endurance experience in assembled by welding components	Automotive OEM Motorcycles; Bikes	Trade Secret	Feasibility studies, TRL upscaling	CRF, ENDUR, ASAS	WP4 D 4.1 D 4.8 D 4.10	TRL 3/7

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	aluminium alloys	providing sound casting especially in the welding zone							
17	New hot stamping part produced with low CRM aluminium alloys	BiW part produced with the material developed	% Recycle content. Reduce CO2 footprint	Automotive OEM	Trade Secret	Sale of Components	GESTAMP	WP5	TRL 7/9
18	New cold stamping part produced with low CRM aluminium alloys	Substitution of 5xxx alloys with 6xxx alloys for structural inner part	Related to Mg due to cost increase and high supply risk	Automotive OEM	Trade Secret	Feasibility studies, TRL upscaling	CRF	WP5 D.5.4	TRL 4/7
19	Partially recycled Al alloy for high performance HPDC	Producing aluminum alloys from HPDC by maximizing the use of aluminum end of life scraps, reducing the use of CRM as they are already contained in the scrap	Using of scrap to produce structural alloys from HPDC is the differentiator factor High electrical conductivity	All automotive value chain and industry; Electronic applications – reduction of internal heating; Electric batteries	Patenting, Trademark, Copyright, Trade Secret	Follow-up research, feasibility studies, policy change, TRL upscaling, spinoff, material and equipment sale, licensing	RAFF, EUT	WP 3	TRL 5 / 7

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20	New Al alloy for HPDC without Si	Produce high-performance aluminum alloys from HPDC by reducing the use of CRMs and without performing heat treatments Optimised composition of Aluminium alloys for HPDC foundries	The combination in the use of particular chemical elements in the right concentrations allow to obtain mechanical performances that avoid heat treatments in HPDC alloys	All value chain and industry Alloy producers, foundries	Patenting, trademark, Copyright, Trade Secret	Follow-up research, feasibility studies, policy change, TRL upscaling, spinoff, material and equipment sale, licensing	RAFF, UNIPD	WP 2 WP 3	TRL 4 / 7
21	New partially recycled Al alloy for stamping	New aluminum alloys for stamping with maximized content of aluminum end of life scraps, reducing the use of CRM as they are already contained in the scrap	Using of scrap to produce structural alloys for stamping is the differentiator factor	All value chain and industry	Patenting, trademark, Copyright, Trade Secret	Feasibility studies, TRL upscalin, material sale,	PROFIL, EUT	WP 2 WP 3 WP 5	TRL 4/8 (EUT) TRL 3/7 (PROFIL)
22	New Al alloys with reduced CRM content for stamping	Optimised composition of Aluminium alloys for stamping	Competitive Advantage: Combining technological and environmental sustainability of Aluminium alloys for stamped automotive component	Automotive OEMs, stamping manufacturers, Alloy producers, Transformers	Patenting, trademark, Copyright, Trade Secret	Feasibility studies, TRL upscalin, material sale,	PROFIL, UNIPD	WP 2	TRL 3/7

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				of Aluminium sheets					
23	New partially recycled Al alloy for extrusion	New aluminum alloys for extrusion with maximized content of aluminum end of life scraps, reducing the use of CRM as they are already contained in the scrap	Using of scrap to produce structural alloys for extrusion is the differentiator factor	All value chain and industry	Patenting, trademark, Copyright, Trade Secret	Feasibility studies, TRL upscalin, material sale,	ASAS, EUT, IMN	WP 1 WP 6	
24	New Al alloy with reduced CRM content for extrusion	Optimised composition of Aluminium alloys for extrusion	Combining technological and environmental sustainability of Aluminium alloys for extruded automotive components	Alloy producers, Extruders of Aluminium alloys	Patenting, trademark, Copyright, Trade Secret	Feasibility studies, data elaboration, TRL upscaling	ASAS, IMN, UNIPD	WP 2	TRL 5/7

2.2.4. Industrially Applied ICT Solutions

Table 5. Exploitable Results: Industrially Applied ICT Solutions

#	Exploitable result	Description	Value Proposition (competitive advantage, differentiating factors)	Target sectors	IPR	Exploitation route	Owner	Associated WP	TRL (beginning /expected)

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								(WP/Deliverable)	
25	Validated simulation models and data sheet of alloys properties for: HPDC, Hot and Cold Stamping and Extrusion processes	The industrial try-out will contribute in the validation of virtual HPDC simulation that will reproduce the Hold and Cold Stamping and Extrusion processes. The required properties for modelling and simulating the metal casting process will be characterized for the most promising aluminium alloys	Differentiating factor: Improved simulation models for optimization of the part&process design of parts with new SALEMA alloys. FE modelling will be used to verify that the components can be produced and predict limitations. It will be used to assist the design and optimization of the processes for manufacturing the industrial scale demonstrators. Some of the relevant properties to be characterized are thermal conductivity, specific heat, coefficient of thermal expansion or yield stress at different temperatures and deformation velocities.	Aluminium alloy producers, HPDC, extruding or stamping manufacturers, research community	Trade Secret	Specialised services, new R&D projects, Internal use and Feasibility Studies	All industrial partners	WP 4 WP 5 WP 6	TRL 4/7

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25.1	Simulation Model for HPDC	Simulation models that reproduce the HPDC process		HPDC Manufacturers;	Trade Secret	Specialised services, new R&D projects, Internal use and Feasibility Studies	All industrial partners	WP4	TRL 4/7
25.2	Simulation Model for Hot and Cold Stamping	Simulation models that reproduce the Hot and Cold Stamping process		Stamping Manufacturers;	Trade Secret	Specialised services, new R&D projects, Internal use and Feasibility Studies	All industrial partners	WP5	TRL 4/7
25.3	Simulation Model for Extrusion	Simulation models that reproduce the Extrusion process		Extrusion Manufacturers;	Trade Secret	Specialised services, new R&D projects, Internal use and Feasibility Studies	All industrial partners	WP6	TRL 4/7

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The table sections were divided into the identification of the Key Exploitable Result, their description and Value Proposition, initially targeted sectors or applications, initial IP Protection, Initial Exploitation/Commercialization route, Main Owners, the Work Package where it was developed and the initial/expected TRL level of the innovation by the end of the project.

This document will be kept updated throughout the project lifecycle and will be updated regularly during major events and meetings of the Consortium.

2.3. Changes and Updates

Major changes were made during these first 19 months of the project related to the Key Exploitable Results.

These updates resulted from:

- **1 on 1 meetings** held with partners to support them in the development of their initial exploitation plans and filling of the Exploitable tables;
- **Monthly Project Board Meetings** where disucsisons were promoted when WP8 was presented;
- **2 Workshops** delivered so far, that will be discussed further in the document;
- **Presential General Assembly** where the results were discussed one by one and presented to the whole Consortium.

Table 6. Changes made to Exploitable results

#	Exploitable Result	Owner	Action
8	Increment of technology that enables scrap raw material usage	IMN	Removed
10	Sustainable environment which will sustained from better recyclability	IMN	Removed
25	Validated simulation model for HPDC, Hot and Cold Stamping and Extrusion processes	ALL Industrial Partners	Integrated with KER26
25.1	Simulation Model for HPDC	ALL Industrial Partners	New
25.2	Simulation Model for Hot and Cold Stamping	ALL Industrial Partners	New
25.3	Simulation Model for Extrusion	ALL Industrial Partners	New
26	Data sheet of alloys properties for process simulation	ALL Industrial Partners	Integrated with KER25
27	Publication of peer-reviewed articles in high impact journals	All Partners	Removed
28	Publication of business and marketing alike content	All Partners	Removed

From the summarized table it is possible to conclude that the polish partners of Instytut Metali Niezelaznych (IMN) now concluded that both their technological developments of novel methods developed (KER 8 and KER 10) in the project would not achieve proper results worth exploiting or exploring further.

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We got also feedback from the industrial partners to compile both ICT Solutions into just 1 set of results, comprised of all of the simulation models that will result from the different manufacturing processes. This was then divided in 3 specific results, descending from the integration of both KER 25 and KER 26, that will be speficic for each of the processes: HPDC, Hot and Cold Stamping and Extrusion.

Lastly, results number 27 and 28 were removed due to incompabilities in the definition of exploitable results. Although they were initially identified in the proposal stage, a decision has been made to remove them from the ongoing list of Exploitable Results. These materials will be developed mostly by the Dissemination and Communication partners and are concluded to be Dissemination materials derived from the project.

This strategy will result in a better evaluation model for their exploitation strategies and division of ownership between the partners later on in the project.

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3. Identification and Protection

This section of the document will be dedicated to the Task 10.4, that though it hasn't a specific deliverable associated to it, it is highly connected and of extreme importance to Exploitation, and all work associated with it.

The protection process, measures and work developed so far in the identification of possible protection strategies for each of the results will be described in this chapter.

3.1. Background

The IPR Management focuses on handling the IPR issues in SALEMA project, identify the protection route for each of the Key Exploitable Results (KER) that are of strategic importance, and establish the best approach in order to facilitate the exploitation of these solutions.

It aims to create a favourable environment for respecting intellectual property rights (IPR), permanent IP monitoring during the project, and guaranteeing a standardized approach by all the SALEMA consortium participants.

When it comes to European funded projects, SALEMA, like so many other projects, has a tight and well defined policy when it comes to Intellectual Property Rights (IPRs).

IP confers on individuals, enterprises or other entities the right to exclude others from the use of their creations. Consequently, intellectual property rights may have a direct and substantial impact on industry and trade as the owner of an IPR may - through the enforcement of such a right - prevent the manufacture, use or sale of a product which incorporates the IPR.

For this reason control over the intangible asset (IPR) connotes control of the product and markets. This is especially important and fundamental for European Projects, as they are mostly research-related ventures with a Consortium of different partners. Each of them are responsible for diferent tasks (involved or not with R&D) which will produce results that can be exploited in multiple ways (either commercially, or internally by each organization).

Although more information can be found in both the Consortium Agreement (CA) and in the Grant Agreement (GA), there are some sections related to IPR that are important to describe in this section for a better understanding of the rest of the document.

In the Grant Agreement, subsection 3 – Rights and Obligations related to results, it can be found:

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26.1 Ownership by the beneficiary that generates the results

Results are owned by the beneficiary that generates them.

'**Results**' means any (tangible or intangible) output of the action such as data, knowledge or information — whatever its form or nature, whether it can be protected or not — that is generated in the action, as well as any rights attached to it, including intellectual property rights.

26.2 Joint ownership by several beneficiaries

Two or more beneficiaries own results jointly if:

(a) they have jointly generated them and

(b) it is not possible to:

(i) establish the respective contribution of each beneficiary, or

(ii) separate them for the purpose of applying for, obtaining or maintaining their protection (see Article 27).

The joint owners must agree (in writing) on the allocation and terms of exercise of their joint ownership ('**joint ownership agreement**'), to ensure compliance with their obligations under this Agreement.

Unless otherwise agreed in the joint ownership agreement, each joint owner may grant non-exclusive licences to third parties to exploit jointly-owned results (without any right to sub-license), if the other joint owners are given:

(a) at least 45 days advance notice and

(b) fair and reasonable compensation.

Once the results have been generated, joint owners may agree (in writing) to apply another regime than joint ownership (such as, for instance, transfer to a single owner (see Article 30) with access rights for the others).

Figure 2. Articles 26.1 and 26.2 from the SALEMA Grant Agreement

These articles mean that for each of the results identified in the SALEMA Consortium, an analysis of ownership must be made to define future exploitation strategies. If the result was developed solely by one partner, then it fully owns that results after the project ends. However, if several partners were involved in the innovation development, they will have to agree a joint ownership strategy for that specific result between them.

Related to the obligation to guarantee the protection of results, in the Grant Agreement, specifically the article 27, also provides an insight of general guidelines that must be followed to preserve the interests of the beneficiaries.

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27.1 Obligation to protect the results

Each beneficiary must examine the possibility of protecting its results and must adequately protect them — for an appropriate period and with appropriate territorial coverage — if:

(a) the results can reasonably be expected to be commercially or industrially exploited and

(b) protecting them is possible, reasonable and justified (given the circumstances).

When deciding on protection, the beneficiary must consider its own legitimate interests and the legitimate interests (especially commercial) of the other beneficiaries.

Figure 3. Article 27.1 from the SALEMA Grant Agreement

This article claims that an identification of the project results is mandatory if specific interests from the partners are met (either commercialization or protection of the result). This can only be done with specific actions and tasks, such as the ones presented in this document.

The work developed will allow for a characterization of each of the project's results and the conclusions, ongoing route to final exploitation, and use for these innovative technologies, will be presented at the end of the project.

3.2. IPR in SALEMA

SALEMA IPR strategy was defined in order to satisfy multiple objectives: identification of technologies and innovations developed through the project, selection of an individual protection strategy for each of them, thus avoiding the disclosure, appropriation or premature exploitation of the results.

Finally, the conclusions taken from this detailed analaysis of each technology will support the development of the business plans and feasibility study promoted by other partners during the project. Eurecat is responsible for both Exploitation and IP management tasks,thus in charge of the following responsibilities:

- **Act as the first point of contact with regard to queries over IPR and ownership offering guidance regarding interpretations of the rules and regulations stated in the Grant Agreement and Consortium Agreement;**
- **IP management includes ensuring partners are made aware of the procedures designed to record IP, maintain its confidentiality;**
- **Making sure that IPR is exploited where possible;**
- **Keeping a track of potential patents;**
- **Moderating access and consensual agreements to Results and Background if necessary;**
- **Maintain an updated registry of any IP identified as Results or Background.**

An online IPR management section in the Exploitation tables has been created in order to be revised and extended with new pieces of knowledge (foreground) as project implementation advances; exploring the opportunity for applying for patents or declaring copyrights.
Moreover, a visual overview of the IPR management efforts foreseen in the SALEMA project can be found below:

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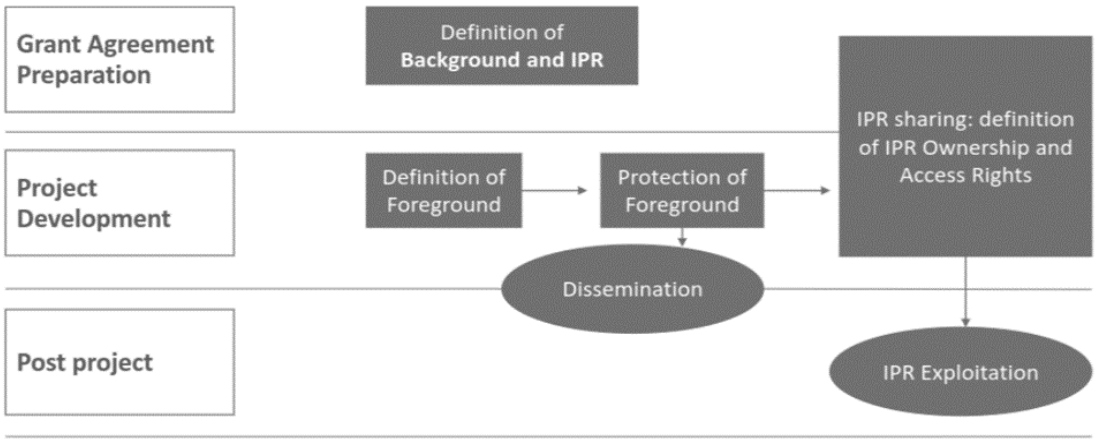

Figure 4. Overall methodology of IPR protection in SALEMA

Over the past 7 months of the project (M12-M19), the Exploitation + IPR management tables were sent out to every partner, where they could update and add new information related to the identification of new technological results, background brought to the project and foreground expected to be resulting from it by the end of M36.

It is important to note that we are still in an early stage of the project, so there is still a lot of uncertainty regarding the development of innovations, mainly the ones that are dependant on industrial manufacturing. Nevertheless, important information was collected that will define actions throughout the project, mainly related to exploitation and innovation management tasks.

3.3. Protection Path Identification

In addition to the identification of project results, its characterisation and background brought from partners, it is crucial that an individual protection strategy is defined for each of the Exploitable Results.

An initial list of possible protection strategies (that are suited for the SALEMA Project Results) was identified:

- **Patenting – Any invention, product or process that offers a new way of doing something or provides a new solution to a problem;**
- **Utility Model – Minor inventions or minor improvements of existing products;**
- **Trademark – Any sign capable of distinguishing your goods or services from your competitors;**
- **Copyright – Literary and artistic works: music, books, paintings, computer programmes, databases, etc.;**
- **Trade Secret – Any information that is not generally known, confers a competitive edge and is subject to reasonable efforts to maintain its secrecy;**
- **Geographical Indications - Signs used on goods with a specific geographical origin and which possess qualities, reputation or characteristics mainly related to that place of origin.**

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From the initial assessment and interviews with partners, it is clear to see from the analysis and compilation of Table 7, that the initial idea from the partners is mainly to keep their newly developments as Trade Secrets, so that they can continue their internal research and improvements. Then, other options are also followed, mainly connected with a more open approach to commercialization, while maintaining the control over the novelty either as Copyright, Trademark and possibility Patenting the results.

Table 7. Identification of Initial Protection Strategy per Result

Protection strategy	Exploitable Results identified	Total number
Patenting	3, 6, 19, 20, 21, 22, 23, 24	8
Copyright	15, 19, 20, 21, 22, 23, 24	7
Open Source	1, 2	2
Trade Secret	3, 4, 5, 6, 7, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25 (+3 sub results)	24
Trademark	15, 19, 20, 21, 22, 23, 24	7

These protection paths are far from the final decisions of the partners, but correspond to an initial one, as there are still a lot of uncertainty about the development of the technologies. Some overlap was also identified by lack of knowledge from the partners and multiple ownership by them.

In the end, as part of the monitoring and identification strategy, any outcomes of the projects will be constantly updated and assessed until the conclusion of the project, and a final protection strategy for the Exploitable Results will be delivered in D8.11, together with the final Exploitation Report at M36.

3.4. Commercialization Paths Identification

Individual Exploitation

Based on the initial assessment, it is possible to identify some options and paths for commercialization for partners.

These will be further detailed for specific partners in the final Exploitation Deliverable. However, some interesting commercialization approaches include:

- **Licensing;**
- **Franchising;**
- **Joint Venture;**
- **Spin-off;**

Joint Exploitation

For results owned by more than one partner (as co-owners or contributors), the concerned partners will have to agree on a joint exploitation strategy. Depending on this strategy, partners will have to prepare a separate agreement. In the final deliverable related to IPR, an overview of any possible Joint Exploitation approaches will be identified.

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The most common agreements derived from collaborative results are:

- **Collaboration agreements, for follow-up research interest;**
- **Service agreements, for transfer or use of the knowledge developed during the project;**
- **Material Transfer Agreement (MTA) that regulate the future use of materials, procedures, software, protocol, etc.;**
- **Non-disclosure agreement / Confidentiality agreement (NDA / CDA) to exchange confidential information for a defined purpose;**
- **Memorandum of Understanding / Letter of Intent (MoU / LoI) to set the conditions to be fulfilled before going any further;**
- **Licensing agreements, to agree on royalties for the use or exploitation of a particular result.**

3.5. Other Protection

Documentation and Scientific Articles

Key practical procedures will be adopted in the project to ensure that the security and integrity of its IP is maintained. Some of the key agreed procedures and additional IP supporting documents to consider are included below:

- **Before any relevant publication of SALEMA results, partners will contact the project coordinator and IPR Manager to verify if these do not infringe IP rights.**
- **Before submitting any paper for publication, it is necessary to inform the consortium and show what is going to be presented publicly.**
- **The IP/exploitation manager, WP coordinator and other involved technical partners will advise on the appropriateness of such a publication and recommend suitable amendments to the information where it deems necessary.**

If required, partners may be asked to submit/ fill in:

- **Invention Disclosure Forms (IDF): invention disclosure forms can be made available to project partners. The purpose of this form is to provide a record of the invention, obtain a consensual description and gather enough information to commence a potential patent filing process.**
- **Non-Disclosure Agreement (NDA): during the development of the project, all participants were already requested to sign a 'Confidentiality Agreement' and/or a "Letter of Intent" Form. The CA establishes the confidential framework of SALEMA among its partners during its execution. Further NDA templates can be provided to project partners if they plan to conduct meetings with external partners, suppliers or customers alongside the project development.**
- **Open access to peer-reviewed scientific publications: SALEMA Consortium agrees with the key principles of the Europe 2020 Strategy for a smart,**

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sustainable and inclusive economy, as well as, with the EC Guidelines on Open Access to Scientific Publications and Research Data in Horizon 2020.

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4. Prioritization and Main Results

4.1. Methodology

As there were currently too many Exploitable Results (+20) - through multiple iterations and by identifying a strategy that would allow to filter, prioritize, assess the Key Exploitable Results with more impact and that will provide more value to the SALEMA partners – was one of the main objectives for the first months of the project.

The goal is to define a smaller number of Exploitable Results, that can be further developed in terms of business and exploitation possibilities. These will be highlighted until the end of the project, and be a central point in the future market analysis and business modelling strategy for the partners who were responsible for their development.

In the end, a fair, simple strategy to tailor the big number of identified results deriving from the project was formulated in order to filter them into key, essential and beneficial ones for the partners. This was done using scoring tools and prioritization strategies.

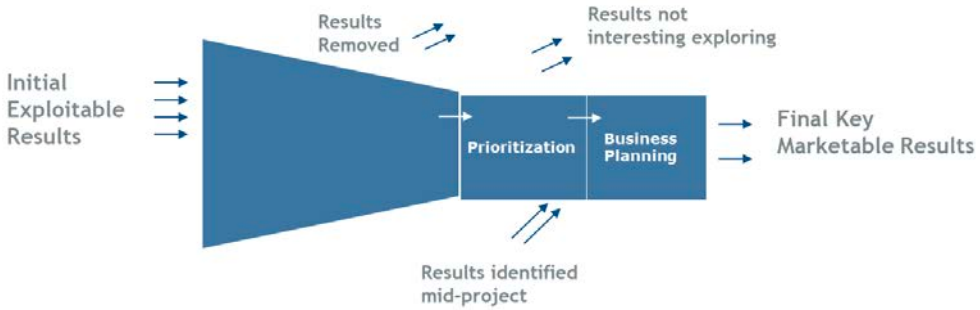

Figure 5. Prioritization Methodology for SALEMA

4.2. Prioritization

Due to the large number of results identified at the beginning of the project, an important part of the first steps of the project was to define the importance of each of these results and establish an order of priority for all of them, so that it is possible to give more attention and provide a more detailed analysis to the most important ones.

Exploitation Workshop

For this task, a Exploitation Workshop was held with all the partners of the consortium in June 2022. Lasting for 2 hour,in this online session, each of the results was presented to the partners one by one, and briefly described by the partners, providing an insight how their development and research was going, as well their personal opinions on their development.

At least one of each Exploitation Partners were asked to join the online workshop. It was fundamental the participation of the maximum amount of people that had both technical and business knowledge related to the novelty development and internal situation of the company. Due to the great support

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and enthusiasm of the partners that participated, it was concluded that the workshop was a key and successful cornerstone of the project.

Table 8 Participating partners in the Exploitation Workshop

Participating Partners
Manel Da Silva López (EUT)
Eva Gonzalez (FAGOR)
Isabel Linares Nicolas (UNE)
Giovanni Sbrega (PROFIL)
Sonia Boczkal (IMN)
Claudio Mus (ENDUR)
Daniele De Caro (CRF)
Maria Violeta Vargas Parra (EUT)
Bonollo Franco (UNIPD)
Juan Jose Matarranz Palomo (GESTAMP)
Pierre Fiasse (COMET)
Andrea Bongiovanni (CRF)
Tutku Özen (ASAS)
Sylvia Andrea Cruz Torres (EUT)
İlyas Artunç Sarı (ASAS)
Warkentin (Ford)

The methodology proposed was really straightforward and had as a main objective the prioritization of the results, and promote the active discussion of the partners.

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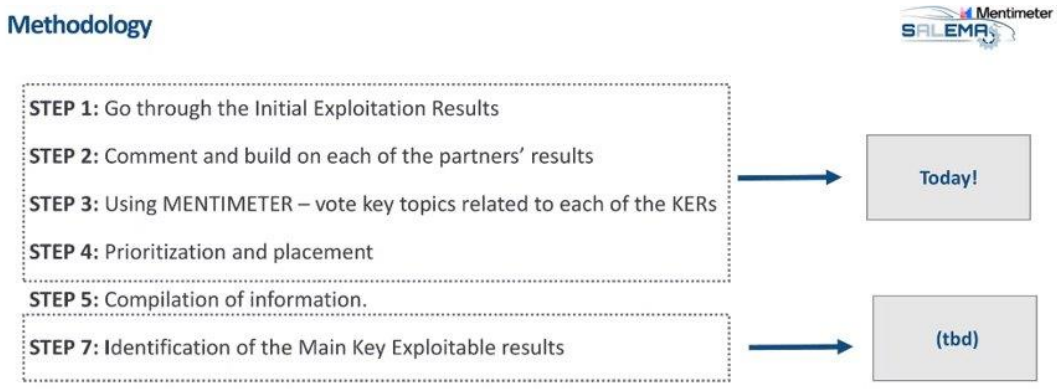

Figure 6. Methodology of the workshop

More than 25 "Exploitation Result Cards" were created to allow a better visualization and customization of the project results. This strategy proved to be very successful, and these cards and visual strategy will be maintained until the end of the project, not only for presentation purposes but as well as for future workshops and working sessions with the Consortium.

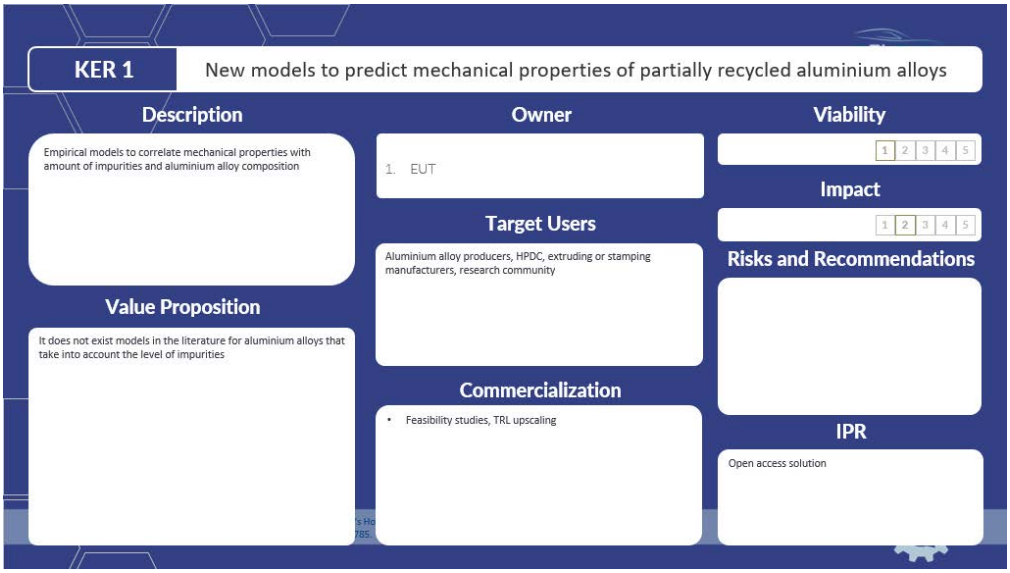

Figure 7 Example of a "Exploitation Result Card"

After each short presentation and using the Mentimeter tool (an online software tool that allows groupal voting by entering a common code and then viewing the results), a voting session was held where the partners were asked to choose from 1 to 5 based on 4 different criteria.

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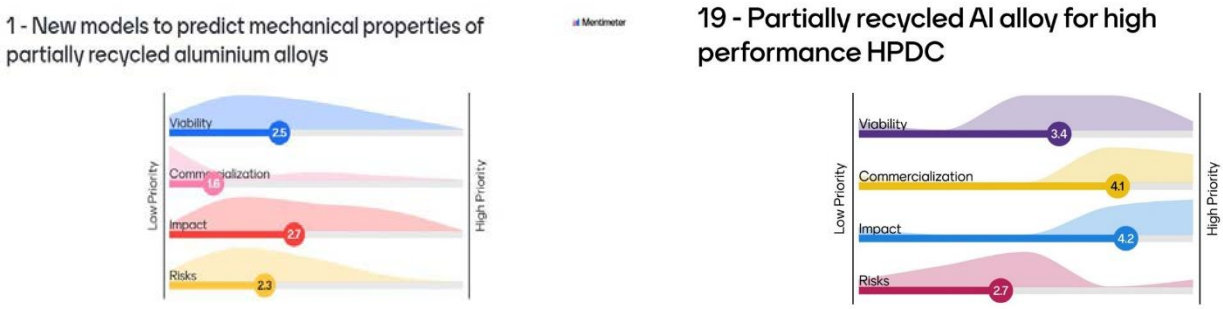

Figure 8. Comparison between two different voted results

In order to prioritize and filter the identified results, the proposed strategy was based on defining Key Factors of criteria that were evaluated and supported with the assessment of the risk and weakness, viability and importance, impact and commercialization potential of each of the results of the SALEMA project.

- **Viability;**
- **Commercialization;**
- **Impact;**
- **Risk.**

In this way, after de session, a numerical an objective analysis of each of the results was made and in this way, a final punctuation was obtained for each of them. Therefore, an order of priority was possible to extract from the entire initial list of results.

For the analysis, the first thing that done was the average of all the punctuations for the four voting criteria of each result. Once all these data were obtained, a weight percentage was defined on the final score for each of the criteria. After a period of reflection, the defined percentages were as follows:

- **Viability – 30%**
- **Commercialization – 30%**
- **Impact – 25%**
- **Risk – 15%**

In summary, the formula of the final punctuation for each result using the averages of all the votations is the following one:

Final Punctuation = Viability*0.3 + Commercialization*0.3 + Impact*0.25 + Risk*0.15

Results

In order to give a more visual representation of the previously commented values and the priority results of the SALEMA project, the following figure has been created.

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Figure 9: Visual chart of the main/priority SALEMA results

For the interpretation of the graph, the first thing to understand is the variables used to build it and how are they represented in it.

To make a graph of this type, three variables must be used: the X axis, the Y axis, and the size of the bubbles. Taking this into account and seeing that in our votation is on four criteria, the first thing done is convert two of these criteria into a one variable.

It has been chosen to join the voting criteria of Viability and Commercialization, using this "new" variable as the X axis of the graph.
On the Y axis we will find the criteria of Risk, and finally, the size of the bubbles will reflect the Impact of the results.

Knowing this we can now interpret the graph. The criteria (or variable) that is found in the X axis is a positive one, therefore, the higher the value is, the better and more important the result will be. The criteria (or variable) found in the Y axis is a negative one, so, the higher value is, the worts and less important the result will be.
Looking at the size of the bubbles, is needed to consider that a large size of a bubble, means a higher impact for the result (also a positive criteria).

In summary, the priority results of SALEMA project will be the ones located in low-right quadrant with larger size of bubbles:

- **High Viability and Commercialization potential;**
- **Low Risk;**
- **High Impact;**

4.3. Main Results after the analysis (TOP 8)

After all this numerical analysis shown in the previous graph, the first 8 results obtained from the prioritization (8 with the highest punctuation) have been considered the main results for the projecte,

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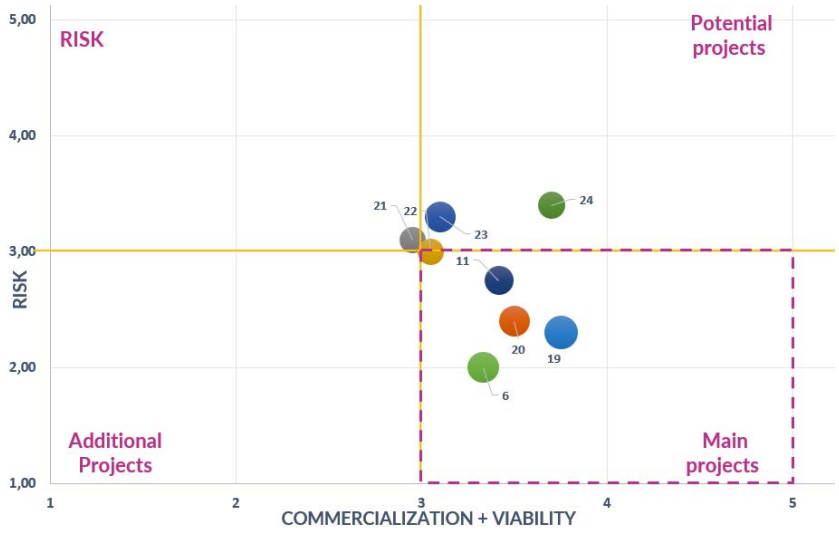
the most relevant ones. Here is the same chart shown before with only the Top 8 represented, and also a table with the punctuation for each of them.



Result	Puntuation
KER 19	7,37
KER 24	7,12
KER 20	6,95
KER 11	6,8
KER 23	6,69
KER 6	6,65
KER 22	6,25
KER 21	6,17

Figure 10: Visual representation and numerical values of Main results (TOP 8)

Once these main results have been defined, the partners involved in all of them have been asked to complete a table to develop and expand the informationfor each technology. This will be one of the main documents to be continuously updated throughout the lifetime of the project.
Attached below is the information provided:

4.3.1. TOP 1: Key Exploitable Result 19 – Partially recycled Al alloy for high performance HPDC

KER's description	
Problem identified	1 – compliance with chemical composition limits 2 – Shortage of aluminum scrap suitable for the production of high-performance alloys for HPDC 3 – by melting aluminum scrap, a high level of skin contamination and oxide inclusions are found in the resulting alloy
Solution proposed	1 – Accurate analysis and management of the scrap used and improved alloy melting and alloying system 2 – End of life scrap: Improving the accuracy and productivity of automatic sorting of aluminum scrap makes it possible to recover good quality scrap even from mixed materials that cannot be used today Process scrap: By increasing the closed-loop relationship (circular economy) with end users, high-quality process scrap can be easily recovered. 3 – Accurate metal cleaning treatments with specific fluxes during both scrap melting and scrap alloying can remove inclusions present in the aluminum alloy due to the scrap refining process
KER's market positioning	
Level of innovation introduced compared to existing	The high performance for HPDC aluminum scrap processing and sorting, casting, and alloy cleaning system developed in the SALEMA project allows a high percentage of recycled material to be used while reducing the use of CRM

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offerings in the market	
Unique selling points / competitive advantage	The advantages are manifold both from a production point of view and from the point of view of the environment and the valorization of raw materials found in Europe. In fact, being alloys produced using mainly from scrap present in our territory, we do not depend on the importation of raw materials from outside Europe. In addition, alloys from recycled materials allow an energy saving in the production phase of 95% compared to the same production with primary aluminum and a 90% reduction in carbon footprint.
Key competitors	The key competitors are non-European alloy producers who buy high-quality scrap from Europe depriving us of a key resource and a huge energy bank
Market size and main market applications	Partially recycled Al alloys for high performance HPDC are principally used to make chassis components for combustion but especially electric cars. Market size is important given the increasing use of aluminium in the chassis of cars to reduce its weight and thus its fuel consumption and increase its range
Legal, normative, or ethical requirements	
KER's market strategy	
Approach to KER exploitation, business model	Follow-up research, feasibility studies, policy change, TRL upscaling, spinoff, material and equipment sale, licensing.
Early adopters - List of initial clients	Fagor – FORD
Time-to-market and go-to-market approach	Raffmetal has an established partially recycled Al alloys for high performance HPDC production process. Alloys similar to those developed by the SALEMA project have already been tested by many die casters
Foreseen product/service revenue stream, price, costs. Investment needed after project ends.	
KER's IPR status	
Main owner/s of the result	Raffmetal
Other partners involved in developing the result	All SALEMA Partners involved
Other partners involved in commercialising the result	
Relationship description between the interested owners	

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IPR strategy (have you protected, or will you protect this result? How? When?)	Patenting, Trademark, Copyright, Trade Secret

Table 9: Key Exploitable Result 19 description

This Ker associated at the WP3 (belonging to New Automotive Parts Developed group), is about producing aluminium alloys from HPDC by maximizing the use of aluminium and of life scraps, reducing the use of CRM as they are already contained in the scrap; and the value proposition of it is the using of scrap to produce structural alloys from HPDC (differentiation factor) and the high electrical conductivity.
The target sectors are all the automotive value chain and industry, and it has electronic applications. The owners intend to exploit it in different ways: following-up on the research, making feasibility studies, with policy change and TRL upscaling, as a spinoff, as a material and equipment sale, and also maybe licensing it. Finally, in terms of protection it will be protected with patents, copyright, and as a trademark and trade secret.

4.3.2. TOP 2: Key Exploitable Result 24 – New Al alloy with reduced CRM content for extrusion

KER's description	
Problem identified	Reduction of CRM alloying elements in Aluminium alloys (6000 group), without decrease of properties.
Solution proposed	Development of Aluminium alloys (6000 group) with reduced amount of Si and Mg, but still suitable for heat treatment, and with solution strengthening given by alternative alloying elements.
KER's market positioning	
Level of innovation introduced compared to existing offerings in the market	Optimization of composition, in the frame of Aluminium alloys already included in existing standards.
Unique selling points / competitive advantage	Availability of Aluminium extrusion alloys with minimized amount of Si and Mg, but assuring required mechanical and technological behaviour.
Key competitors	Producers of Aluminium alloys for extrusion and/or extruded bars
Market size and main market applications	The global aluminum extrusion market size was valued at USD 87.84 billion in 2021 and is expected to expand at a compound annual growth rate (CAGR) of 7.5% from 2022 to 2030. The most common Aluminium alloy used for extrusion is the 6000 series. Building and construction, automotive components and photovoltaic support structures are the most popular end-use categories
Legal, normative, or ethical requirements	No specific requirements.
KER's market strategy	

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Approach to KER exploitation, business model	Feasibility studies, data elaboration, TRL upscaling. Business model is integrated in the current production and selling of extruded Aluminium alloys.
Early adopters - List of initial clients	Initial clients are those already available in ASAS' portfolio.
Time-to-market and go-to-market approach	Very short, conventional plants can be used for producing innovative alloys and extruded components made of them.
Foreseen product/service revenue stream, price, costs. Investment needed after project ends.	Specific considerations about this item are under development by ASAS
KER's IPR status	
Main owner/s of the result	ASAS
Other partners involved in developing the result	IMN
Other partners involved in commercialising the result	To be defined by ASAS IMN is interested in developing this topic through research and writing articles
Relationship description between the interested owners	To be developed In the future, IMN is interested in developing this topic in various research projects
IPR strategy (have you protected, or will you protect this result? How? When?)	Patenting, trademark, Copyright, Trade Secret

Table 10: Key Exploitable Result 24 description

This KER associated at the WP2 (belonging to New Automotive Parts Developed group), is about developing an optimised composition of Aluminium alloys for extrusion; and the value proposition of it is the combination of technological and environmental sustainability of Aluminium alloys for extruded automotive components.
The target sectors are Alloy producers and Extruders of Aluminium alloys. The owners intend to exploit it in different ways: making feasibility studies, data elaboration and TRL upscaling. Finally, in terms of protection it will be protected with patents, copyright, and as a trademark and trade secret.

4.3.3. TOP 3: Key Exploitable Result 20 – New Al alloy for HPDC with minimum amount of Si

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KER's description	
Problem identified	failure to achieve expected performance
Solution proposed	Do several tests by changing the concentration of the chemical elements identified in WP2 to obtain the expected characteristics
KER's market positioning	
Level of innovation introduced compared to existing offerings in the market	The alloys developed in the SALEMA project, in addition to containing a low content of critical elements, potentially possesses mechanical properties for crash-relevant parts, especially with high ductility (elongation more the 15% and yield strength more than 140 Mpa) in AS CAST condition.
Unique selling points / competitive advantage	No heat treatment necessary to reach high elongation and good yield strength
Key competitors	Aluminum Alloys with high CRM content
Market size and main market applications	Crash-relevant parts with high ductility
Legal, normative, or ethical requirements	
KER's market strategy	
Approach to KER exploitation, business model	Follow-up research, feasibility studies, policy change, TRL upscaling, spinoff, material and equipment sale, licensing
Early adopters - List of initial clients	
Time-to-market and go-to-market approach	Raffmetal has an established low CRM Al alloy for high performance HPDC production process.
Foreseen product/service revenue stream, price, costs. Investment needed after project ends.	
KER's IPR status	
Main owner/s of the result	Raffmetal - UNIPD
Other partners involved in developing the result	FAGOR, ENDUR, EUT
Other partners involved in	EUT is only interested in rights to continue researching on this field

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commercialising the result	
Relationship description between the interested owners	EUT is interested in participating in future European Research Projects with other industrial partners
IPR strategy (have you protected, or will you protect this result? How? When?)	Patenting, trademark, Copyright, Trade Secret

Table 11: Key Exploitable Result 20 description

This KER associated at the WP2 and the WP3 (belonging to New Automotive Parts Developed group), is about producing high-performance aluminium alloys from HPDC by reducing the use of CRMs and without performing heat treatments and optimizing the composition of Aluminium alloys for HPDC foundries. The value proposition of it is the combination in the use of chemical elements in the right concentrations allow to obtain mechanical performances that avoid heat treatments in HPDC alloys. The target sectors are all value chain and industry, alloys producers and foundries. The owners intend to exploit it in different ways: following-up on the research, making feasibility studies, with policy change and TRL upscaling, as a spinoff, as a material and equipment sale, and also maybe licensing it. Finally, in terms of protection it will be protected with patents, copyright, and as a trademark and trade secret.

4.3.4. TOP 4: Key Exploitable Result 11 – Novel HPDC process for casting the new Al alloys

KER's description	
Problem identified	New Al alloys with low CRM could have an impact to the following aspects of the HPDC process: 1) High level of skin contamination, oxide inclusions and sludge factor 2) Low fluidity 3) Solidification behavior affecting shrinkage porosities, hot tears, segregation
Solution proposed	1) Accurate cleaning treatments with specific fluxes for all the metal handling process steps (melting furnace, degassing station and holding furnace) 2) Accurate metal temperature control /die thermal management / gating and shot sleeve design 3) Local solidification control (squeeze -pin / conformal cooling inserts/ dedicated lubrication head/lubricant)
KER's market positioning	
Level of innovation introduced compared to existing	Alloys from recycled materials offer an energy saving in the production phase of 95% compared to the same production with primary aluminum and a 90% reduction in carbon footprint HPDC is overall the aluminum casting technology with the lower energy requirement per kg of final product

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offerings in the market	
Unique selling points / competitive advantage	Circular economy approach and low carbon footprint plus can be offered to Customers that will have, in the near future, to sell "greener" products and processes
Key competitors	Nemak, Magna Cosma, AE Group, Trimet
Market size and main market applications	Europe market size around 100Ktons of products/year, Automotive and 2 wheelers structural component
Legal, normative, or ethical requirements	CO2 footprint upcoming legislation
KER's market strategy	
Approach to KER exploitation, business model	Feasibility studies, TRL upscaling, spinoff, consulting
Early adopters - List of initial clients	Stellantis Group, BMW , VW , Daimler , IVECO , Porsche, Renault
Time-to-market and go-to-market approach	6 months after Salema ends
Foreseen product/service revenue stream, price, costs. Investment needed after project ends.	Revenues: structural casting + 10-20% = total revenues + 1 % Costs: final HPDC product's cost split is generally: 50 % material 40% transformation 10% post processing (including heat treatment if needed) As of now we cannot anticipate the % reduction (or increase) of these 3 main cost categories when using SALEMA alloys Expectations to improve are in the material and post-processing cost reduction
KER's IPR status	
Main owner/s of the result	Endurance Spa, Endurance Amann (now Endurance GmbH) Fagor Ederlan S.Coop.
Other partners involved in developing the result	EUT, RAFF, CRF
Other partners involved in commercialising the result	RAFF EUT is only interested in rights to continue researching on this field
Relationship description between the interested owners	RAFF is already supplier to Endurance Spa and Endurance Amann. RAFF is a potential supplier to FAGOR EUT is interested in participating in future European Research Projects with other industrial partners
IPR strategy (have you	Trade Secret

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protected, or will you protect this result? How? When?)	

Table 12: Key Exploitable Result 11 description

This KER associated at the WP4 (belonging to New Manufacturing Processes group), is about designing, testing, verifying and validating casting process parameters when using SALEMA alloys by HPDC process, and also many concepts form melting to casting will be updated. The value proposition of it is the sustainable process due to low CRM and recycled alloys and the competitive advantage for thin wall casting with structural properties.
The target sectors are EV producers, automotive industry and all value chain and industry. The owners intend to exploit it in different ways: making feasibility studies, TRL upscaling, as a spinoff, and as a consulting service. Finally, in terms of protection it will be protected as a trade secret.

4.3.5. TOP 5: Key Exploitable Result 23 – New Partially recycled Al alloy for extrusion

KER's description	
Problem identified	Aluminium alloys used to produce high performance extruded profiles for structural applications in the automotive industry is based in primary aluminium, which it is highly
Solution proposed	New high performance aluminium alloy produced with a high amount of end of life scrap, by controlling and selecting the scrap composition, as well as by developing new alloy formulations more robust to variable level of impurities.
KER's market positioning	
Level of innovation introduced compared to existing offerings in the market	Alloys from recycled materials offer an energy saving in the production phase of 95% compared to the same production with primary aluminium and a 90% reduction in carbon footprint
Unique selling points / competitive advantage	Circular economy approach and low carbon footprint plus can be offered to Customers that will have, in the near future, to sell "greener" products and processes
Key competitors	Hydro,
Market size and main market applications	Europe market size around 100Ktons of products/year, Automotive and 2 wheelers structural component
Legal, normative, or ethical requirements	CO2 footprint upcoming legislation
KER's market strategy	
Approach to KER exploitation, business model	Feasibility studies, TRL upscaling, material sale
Early adopters - List of initial clients	Stellantis Group, FORD,

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Time-to-market and go-to-market approach	6 months after Salema ends
Foreseen product/service revenue stream, price, costs. Investment needed after project ends.	
KER's IPR status	
Main owner/s of the result	ASAS
Other partners involved in developing the result	IMN, EUT
Other partners interested in commercialising the result	EUT is only interested in rights to continue researching on this field IMN is interested in developing this topic through research and writing articles
Relationship description between the interested owners	EUT is interested in participating in future European Research Projects with other industrial partners In the future, IMN is interested in developing this topic in various research projects
IPR strategy (have you protected, or will you protect this result? How? When?)	Patenting, trademark, Copyright, Trade Secret

Table 13: Key Exploitable Result 23 description

This KER associated at the WP1 and the WP6 (belonging to New Automotive Parts Developed group), is about new aluminium alloys for extrusion with maximized content of aluminium end of life scraps, reducing the use of CRM as they are already contained in the scrap. The value proposition of it is the using of scrap to produce structural alloys for extrusions (differentiator factor).
The target sectors is basically all value chain and industry. The owners intend to exploit it in different ways: making feasibility studies, TRL upscaling and material sale. Finally, in terms of protection it will be protected with patenting, copyright, and as a trademark and trade secret.

4.3.6. TOP 6: Key Exploitable Result 6 – Al series scraps sorting through multi-sensors signatures (3D-XRT-LIBS) on conveyor belts.

KER's description	
Problem identified	Aluminium scraps can not be separated according to their internal composition i.e. their alloying elements.
Solution proposed	A multi-sensor system that exploits machine learning and robotics to sort the different aluminium alloys out of the ZORBA stream.
KER's market positioning	

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Level of innovation introduced compared to existing offerings in the market	• Most existing technologies usually uses XRF which is relevant as a pre-sorting system but cannot really differentiate most of Aluminium families. • Some upcoming systems use LIBS which allows the best differentiation, but such system only perform the sorting with an air ejection blower. As a result, such system can only sort up to 2 families at a time.
Unique selling points / competitive advantage	• Our system integrates the best possible technology for the analysis of the sample: LIBS with ablation capacity. • Our system allows to sort many classes in one single pass and is therefore more adapted for the always stricter requirements of recycling.
Key competitors	TOMRA, STEINERT
Market size and main market applications	Estimation of 1M tons of aluminium scraps generated by ~350 automotive shredders in the EU.
Legal, normative, or ethical requirements	None yet.
KER's market strategy	
Approach to KER exploitation, business model	The members of GeMMe have started the process of incorporating a company that would offer characterization and sorting systems based on instrumentation, artificial intelligence and robotics technology. This company will have the vocation to offer its solutions in order to satisfy specific but demanding demands related to the treatment of industrial waste. In concrete terms, the work of the spin-off will be based on two activities: • The "service" part which will consist in integrating certain developments of GeMMe in an industrial framework by carrying out the finalization of the technology, the setting in production, the follow-up and the maintenance. (This is the role of the GeMMe for the follow-up of the Multipick and Vulcastop projects...), • The "product" part which will consist in selling standardized characterization and sorting equipment integrating a combination of sensors adapted to the flow to be treated (This is the role of GeMMe for Magnesita, the industrialization of Selection, the reproduction of MULTIPICK lines within the framework of Comet Technology.) As GeMMe has developed and is still developing solutions for its partner Comet Traitements, it is necessary that the spin-off does not compromise the agreements and commitments previously established between the partners. Therefore, a discussion between Comet, GeMMe and the spin-off must take place in order to frame the sale of equipment developed during the projects carried out at GeMMe with Comet. The sorting of aluminium alloys by means of LIBS characterization falls into this category. In view of their knowledge of the market and their important network, the most appropriate strategy would be to entrust Comet with the role of marketing the aluminium sorting equipment in the form of an exclusive contract between the spin-off and Comet. The clauses of this contract (geographical, temporal and commercial constraints) remain to be defined but will have to be balanced in order to guarantee to Comet a technological advantage and the control towards its competitors while supporting the growth of the spin-off through the order of machines.

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	In summary, the developments resulting from SALEMA will lead to the creation of sorting machines designed within the spin-off which will then be integrated into production lines installed or sold by Comet.
Early adopters - List of initial clients	Comet Traitements
Time-to-market and go-to-market approach	1 year overall with: • 6 months for the design phase and to adapt the technology for the industrials needs of Comet • 6 months for the assembly and commissioning
Foreseen product/service revenue stream, price, costs. Investment needed after project ends.	Costs: • Hardware (sensors 450k€, 30k€ per robot, mechanical structure 50k€, electrical components,…) • Human resources (Engineers and technicians) • Intangible assets (royalties to Uliège) • Tangible assets (building, equipments,…) Revenue streams: • Selling of systems • Selling of additional software functionalities (yearly licensing) • Service Level Agreement (yearly licensing)
KER's IPR status	
Main owner/s of the result	In order to exploit the result, the following combination of IP is required: • ULIEGE: for the classification algorithm using LIBS developed within the framework of SALEMA and fine-tuned for aluminium scraps. • COMET: for the market knowledge • ULIEGE & COMET: for the PICKIT sorting technology made available for the SALEMA project that is the result of previous projects. (respective proportions to be defined)
Other partners involved in developing the result	• CITIUS ENGINEERING: partner of the previous projects (PICKIT & MULTIPICK) which led to the fabrication of the PICKIT sorting line.
Other partners involved in commercialising the result	
Relationship description between the interested owners	
IPR strategy (have you protected, or will you protect this result? How? When?)	Creation of a company - Spin off.

Table 14: Key Exploitable Result 6 description

This KER associated at the WP7 (belonging to New Methods Developed group), is about the identification of optimal data processing pipeline & software architecture that allows the real-time robotic sorting of Al scraps into several Al series concentrates; and the value proposition is the improving of the recycling rate of Al scraps inside EU, hence decreasing the need for external supply (primary Al).

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The target sector are producers and recyclers and Al scraps collectors. The owners intend to exploit with the creation of a company (Spin off). Finally, in terms of protection it will be protected with patents and as a trade secret.

4.3.7. TOP 7: Key Exploitable Result 22 – New Al alloys with reduced CRM content for stamping

KER's description	
Problem identified	- End of life scrap contains a number of alloying elements, which may complicate achieving a precise composition in low-alloy grades; - the material may be sensitive to the presence of inclusions and contaminations detrimental to formability resulting by melting scrap. - failure to achieve the stamping performance with 5000 alloy series with high content of scrap
Solution proposed	- Move to a 6000 series alloy with a chemical composition more tolerant to the alloying elements typically found in traces in scrap aluminium (Si, Mn and Fe…); - use the precipitation hardening process by the SHT (solubilization heat treatment) to reach the target properties and the final mechanical behavior
KER's market positioning	
Level of innovation introduced compared to existing offerings in the market	The alloy developed allows a considerable reduction of CRM by using an high % of scrap, and could be proposed in a different temper state and mechanical properties to match different needs of carmaker by using the appropriate SHT parameters.
Unique selling points / competitive advantage	The use and remelting of recycled material to produce aluminium for stamping allows the reduction of use of CRM and the valorization of the scrap. The use of scrap instead of the primary aluminium allows an energy saving of 95% in the production phase too. Carmakers already use 6000 series alloys for panels and other BIW components so by the substitution of the 5000 series alloys with a 6000 series for structural and inner parts, the scrap coming from the stamping process will be more uniform and with an higher commercial value and more suitable to be recycled again.
Key competitors	Aluminium alloy from primary aluminium with use of CRM
Market size and main market applications	Stamping components of chassis vehicles as structural part, inner parts or panels. Market size is wide and it is growing up with the increasing of weight reduction of chassis
Legal, normative, or ethical requirements	
KER's market strategy	
Approach to KER exploitation, business model	Feasibility studies, TRL upscaling, material sale
Early adopters - List of initial clients	

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Time-to-market and go-to-market approach	
Foreseen product/service revenue stream, price, costs. Investment needed after project ends.	
KER's IPR status	
Main owner/s of the result	Profilglass
Other partners involved in developing the result	All Salema partners
Other partners involved in commercialising the result	
Relationship description between the interested owners	
IPR strategy (have you protected, or will you protect this result? How? When?)	Patenting, trademark, Copyright, Trade Secret

Table 15: Key Exploitable Result 22 description

This KER associate at the WP2 (belonging to New Automotive Parts Developed group), is about an optimised composition of Aluminium alloys for stamping; and the value proposition is the combining technological and environmental sustainability of Aluminium alloys for stamped automotive component (competitive advantage).
The target sectors are automotive OEMs, stamping manufacturers, Alloy producers and Transformers. The owners intend to exploit it in different ways: making feasibility studies, TRL upscaling and material sale. Finally, in terms of protection it will be protected with patents, copyright, and as a trademark and trade secret.

4.3.8. TOP 8: Key Exploitable Result 21 – New partially recycled Al alloy for stamping

KER's description	
Problem identified	- End of life scrap contains a number of alloying elements, which may complicate achieving a precise composition in low-alloy grades; - the material may be sensitive to the presence of inclusions and contaminations detrimental to formability resulting by melting scrap.

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Solution proposed	- Move to an alloy with a chemical composition more tolerant to the alloying elements typically found in traces in scrap Aluminium (Si, Mn and Fe…); - improving the scrap sorting and management before casting; - use of treatments to increase the metal yield and to reduce inclusion, oxidations and contaminants from the melting phase to the casting.
KER's market positioning	
Level of innovation introduced compared to existing offerings in the market	The alloy developed allows a considerable reduction of CRM by using an high % of scrap.
Unique selling points / competitive advantage	The use and remelting of recycled material to produce aluminium for stamping allows the reduction of use of CRM and the valorizations of the scrap. The use of scrap instead of the primary aluminium allows an energy saving of 95% in the production phase too.
Key competitors	Aluminium alloy from primary aluminium with use of CRM
Market size and main market applications	Stamping components of chassis vehicles as structural part or inner parts. Market size is wide and it is growing up with the increasing of weight reduction of chassis
Legal, normative, or ethical requirements	
KER's market strategy	
Approach to KER exploitation, business model	Feasibility studies, TRL upscaling, material sale
Early adopters - List of initial clients	
Time-to-market and go-to-market approach	
Foreseen product/service revenue stream, price, costs. Investment needed after project ends.	
KER's IPR status	
Main owner/s of the result	Profilglass
Other partners involved in developing the result	All Salema partners
Other partners involved in commercialising the result	

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Relationship description between the interested owners	
IPR strategy (have you protected, or will you protect this result? How? When?)	Patenting, trademark, Copyright, Trade Secret

Table 16: Key Exploitable Result 21 description

This KER associated at the WP2, the WP3 and the WP5 (belonging to New Automotive Parts Developed group), is about new aluminium alloys for stamping with maximized content of aluminium end of life scraps, reducing the use of CRM as they are already contained in the scrap; and the value proposition is the use of scrap to produce structural alloys for stamping (differentiation factor).
The target sectors are basically all value chain and industry. The owners intend to exploit it in different ways: making feasibility studies, TRL upscaling and material sale. Finally, in terms of protection it will be protected with patents, copyright, and as a trademark and trade secret.

5. Conclusion & Next Steps

From the compilation of the information above, it is clear to understand that market strategy of each of the Key Exploitable Results it is still underdeveloped and needs work. This will be one of the main objectives for the second half of the project: the development of a market adoption strategy and subsequent integration in the owner's company business model.

5.1. Conclusion

This document provides plans in the areas of exploitation, IPR Management and prioritization of the key exploitable results, including key progress that has been made for the first 19 months of SALEMA project and is a first approach to the definition of the exploitation strategy of the project results.

Therefore, all exploitable results have been reviewed, properly described and classified. In the end, 23 Exploitable Results plus 3 sub-Results have been identified. 5 possible different Intellectual Property protection strategies have also been identified and will be further developed throughout the project lifecycle.

A definitive methodology was put in place to collect feedback from the exploitable partners, get their insights and facilitate communication and the gather of data related to the developments of the novelties from the project. Based on this approach, and using prioritization strategies, from the 23 identified results, 8 were chosen to be further developed, studied and addressed in the next half of the project due to their commercialization potential, viability of deployment, low risk and great impact on the OEM market.

Initial Protection and Commercialization strategies were also identified and will be further developed during the duration of the project – specially focused on the top 8 results. As the IPR and Exploitation

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tasks are closely related, its results will highly benefit and support one another when its time to develop a final strategy for maximizing the impact of the project.

The SALEMA consortium will use this plan as an initial strategy which will be further updated and reviewed on a regular basis. Exploitation activities will be regularly monitored by the project's Exploitation responsibles, thus guaranteeing the flow of communication, promote discussion and cooperation and synergy opportunities between partners.

5.2. Next Steps

The next steps start with involving all partners in the increasing the effort of developing the final exploitation strategy to ensure successful exploitation and generate the maximum amount of impact from the results of the project.

This will be guaranteed by a series of actions that are planned for the next months of the project:

- **Related with the initial business model approaches and market analysis:**
    - Reporting on M24 (April 2023) of D8.6 "SALEMA Market study and business modelling frameworks";
    - This internal and external analysis of the Consortium will be made using strategic tools to allow for a better understanding and visualization of the outcomes;
    - Market Analysis;
    - Partners Business Models Insights;
    - Initial Business Model Design and Methodology for the Owners of the Main Results.

- **Related with the Exploitation and IPR Management:**
    - Continuously support partners in the development of the Exploitation Results;
    - Guarantee an updated version of the Exploitation table and "live" document available to all partners;
    - Promote the discussion of IP Protection – send a questionnaire for Risk Assessment;
    - 1 on 1 meetings with partners to guarantee protection of results and define final commercialization strategy;
    - Promote Workshops and Working Session to develop key topics important for the Consortium.

As mentioned previously, all partners have committed to contributing to and engaging in exploitation activities to achieve the maximization of impact of SALEMA.

The current version of the exploitation strategy contains gaps that need to be filled in the coming months. It became very clear that some partners have not yet developed a clear shared view of the exploitation landscape surrounding the project, which is common and reasonable for this type of projects. Most partners feel that they will be more prepared to contribute to developing the exploitation strategy and plan towards the end of the project where the concepts and technology are more mature, and at a higher stage of development.

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The next steps will involve encouraging the Main Exploitation Partners to start thinking about exploitation in a strategic way to be able to formulate their answers to key questions related to exploitation. These include questions about possible competitors, expected added value, possible market barriers, the timeline for exploitation, impact on the portfolio and IPR measures, foreseen price and cost structure, prospects and customers, contribution and interdependencies of partners (in terms of know-how, patents), legal and normative requirements (compliance, authorisation, norms…), external partners to be involved, etc.

The steps to be taken after the lifetime of the project and the final exploitation strategy and protection of results will be presented in D8.11. “Final PUDR and Exploitation agreement” document on M36.

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