

ESRIUM

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Deliverable D6.7 Final exploitation plan



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ESRIUM – GA No. 101004181

EGNSS-ENABLED SMART ROAD INFRASTRUCTURE USAGE AND MAINTENANCE FOR INCREASED ENERGY EFFICIENCY AND SAFETY ON EUROPEAN ROAD NETWORKS

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Abstract

ESRIUM is a multi-national project with the common goal to increase the safety and resource efficiency of mobility on the road. The key innovation will be formed by a homogeneous, accurate and recent digital map of road surface damage and road wear. Further addressed as "road wear map", it will contain unique information, which is of value to multiple stakeholders: road operators will be able to lower the road maintenance effort by optimal planning. Further, road operators will be able to lower road wear and increase traffic safety especially for heavy vehicles: considering the market introduction of partly automated truck fleets and platoons, the precise track of these vehicles can be adjusted by communicating precise routing recommendations in- and cross-lane. Truck fleet operators following these recommendations can receive tolling benefits and increase the general safety for their vehicle fleet. Especially with the increasing levels of autonomy, systems will utilize infrastructure support to handle the requirements of the automated driving task and additional external requests. In ESRIUM, these opportunities are addressed by utilizing C-ITS infrastructure and EGNSS based localization in planning the trajectories of such automated vehicles.

Key to the ESRIUM innovation is a precision localization service, which provides reliable locations of road damages and of the vehicles using the roads. Considering a European-level business-case, only Galileo may provide such a service in homogeneous quality, even at very remote locations on the European continent.



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EXECUTIVE SUMMARY

The ESRIUM project's D6.7 Final Exploitation Plan document presents a comprehensive and strategic approach to the exploitation of research outcomes, encompassing both individual and joint efforts of the consortium partners. This detailed report reflects a culmination of concerted efforts aimed at maximizing the commercial potential and societal impact of the ESRIUM project.

The document revisits and updates the initial exploitation strategies, offering an insightful overview of the progress made. It details the range of exploitable assets and knowledge accrued, meticulously categorized based on their advancement levels. Target markets for these outcomes include ADAS system developers, road operators, OEMs, and vehicle end-users, showcasing the project's broad applicability.

ESRIUM has a wealth of 10 assets (also referred in this deliverable as exploitable results) that cover a wide range of technologies. These include datasets for training machine learning models, the ability to sell acquired data directly, and specialized data collection services In addition, it has produced 8 significant knowledge outcomes, which together form the cornerstone for upcoming developments in smart mobility solutions and road infrastructure management. These outcomes include in-depth analyses of long-term alterations in the road infrastructure, thorough methods for interpreting data, and creative approaches to utilizing technology to improve safety and effectiveness in specific situations. This body of knowledge not only supports the outcomes that can be used, but it also makes a significant contribution to the larger academic and scientific community. A significant portion of the plan focuses on the individual exploitation strategies at the partner level. These strategies are tailored for both commercial assets and knowledge results. By delineating these individual plans, the document provides a holistic view of how each partner intends to leverage their contributions, highlighting the diversity and collective strength of the consortium. Each exploitable result's full potential is tapped into by custom exploitation plans. First off, using the created datasets as a foundation for machine learning model training opens a channel of communication with academics and organizations who are interested in comprehending the long-term alterations in road infrastructure. Second, collaborations with public agencies, private businesses, and research institutions looking to obtain important data for infrastructure development and urban planning can be formed through the direct sale of gathered data. Another tactic is providing data collecting as a service, which is best demonstrated by the cooperation with Airport Graz. It seeks to increase impact by implementing customized solutions, utilizing technology for real-time insights, and improving efficiency and safety in certain situations.

Central to the document is the joint exploitation roadmap, which is pivotal in advancing the project's technology to a higher Technology Readiness Level (TRL). This roadmap outlines the consortium's plans for follow-up projects to enhance the system solution's TRL, thereby augmenting the project's impact and market readiness.

The ESRIUM joint exploitation plans, which are the result of careful collaboration, include a detailed plan that includes actions, partner roles, milestones, and financial considerations. Partners in the follow-up project, ESRIUM LS, are unwavering in their pursuit of fresh chances to propel technology forward and maintain pace, even in the face of a financing setback. The roadmap places a strong emphasis on critical activities like improving the business plan, protecting intellectual property, seeking finance, and regulation. These activities are meant to hasten the commercialization of ESRIUM and its societal impact on the sustainability and efficiency of road maintenance. A strategic emphasis is demonstrated by the defined milestones, budgetary estimates, and targeted client segments, which guarantee a smooth project closure and ongoing advancement of transportation networks and employment development. The demand for road infrastructure management systems is high and coming from a variety of sources, indicating the market's enormous potential. Our goal to bring the whole ESRIUM solution to market exposed the current disparity in maturity levels



demanded by external industry partners. It is noteworthy that road operators clearly favor an allinclusive, comprehensive solution from a single source, which helped to establish the foundation for ESRIUM's integrated approach. As a result of our investigation, concessionaires are reluctant to adopt long-term predictive road repair solutions and are more likely to support state-mandated modest road maintenance expenditures. Despite this, the market offers encouraging opportunities due to the requirement for effective road management systems, which necessitates an integrated solution covering all aspects of road wear and maintenance. ESRIUM seeks to close these gaps by comprehending the subtleties of stakeholder choices and industry demands as we navigate the commercialization route. The solution consists of a collection of technological elements designed to provide a full road wear management solution, which leads to the creation of an all-encompassing ESRIUM value chain. Furthermore, the comprehensive market analysis we conducted demonstrated the sizeable target market, which is propelled by imperatives such the growing demand for effective road management and maintenance systems. But the market is changing, as seen by the demands of diverse stakeholders in different places, necessitating flexible solutions. With its end-to-end road wear management unique selling concept, ESRIUM innovation gives it a competitive advantage in the market. The goal of this innovation is to give road operators a turnkey solution, simplifying their maintenance procedures and improving infrastructure management in general. The financial estimates indicate a growth trajectory and suggest potential revenue sources in spite of the hurdles presented by divergent stakeholder expectations. Even if they are subject to changes in the market, the projected profits show that ESRIUM has the ability to provide significant value to its stakeholders.

The document conducts a thorough analysis of potential barriers and risks using a structured risk assessment methodology and a priority map. This analysis is critical in identifying challenges and developing effective mitigation strategies, ensuring a proactive approach to risk management. The various barriers that stand in the way of utilizing ESRIUM's findings both individually and collectively are complex. Partners must overcome barriers relating to technological complexity on their own, such as the requirement for improvements to reach a higher Technology Readiness Level (TRL). Financial limitations, such as finding sufficient financing for follow-up initiatives like ESRIUM LS, continue to be a major obstacle. Partners also face challenges when it comes to engaging customers, which calls for a deeper comprehension of their wants and needs as well as the development of strong marketing and sales plans. Together, the consortium faces obstacles in influencing policy while attempting to negotiate regulatory environments for broader commercial acceptance. Furthermore, establishing partnerships with possible rivals and third-party organizations brings challenges that necessitate careful consideration and synergy detection.

The exploitation strategy has been significantly refined through the engagement with Horizon Result Booster (HRB) services. This includes Portfolio Dissemination and Exploitation Strategy (PDES), Business Strategy Development (BPD), and Go to Market (G2M) support, which have provided essential insights and assistance in enhancing the project's commercialization potential.

The report details the project's efforts in exploring commercialization avenues, including discussions with key industry players. These engagements have opened opportunities for presenting the ESRIUM project and exploring potential collaborations, essential for aligning the project with market needs.

In conclusion, the ESRIUM D6.7 Final Exploitation Plan is a testament to the project's commitment to achieving commercial success and societal impact. The plan not only outlines the concerted efforts of the consortium partners but also sets a strategic roadmap for the efficient exploitation of the project's outcomes. It positions the ESRIUM project as a significant contributor to advancements in road infrastructure and transportation networks, ready to meet the challenges of modern road safety and sustainability.



ACRONYMS USED

Acronym	Explanation
AD	Autonomous Driving
ADAS	Advanced Driver Assistance Systems
AR	Augmented Reality
AVs	Autonomous Vehicles
BPD	Business Plan Development
C-ITS	Cooperative Intelligent Transport Systems
D	Deliverable
D&E	Dissemination and Exploitation
EGNSS	European Global Navigation Satellite System
GPS	Global Positioning System
G2M	Go To Market
HRB	Horizon Result Booster
IoE	Internet of Everything
IoT	Internet of Things
OEMs	Original Equipment Manufacturers
PDES	Portfolio Dissemination and Exploitation Strategy
SAM	Serviceable Available Market
SOM	Serviceable Obtainable Market
Т	Task
TAM	Total Available Market
TRL	Technology Readiness Level
V2X	Vehicle-to-Everything Communication
VR	Virtual Reality

Table 1: List of acronyms.



SECTION 1: INTRODUCTION

As the ESRIUM project is progressing towards its final stage, it is essential to have a clear and effective plan for the exploitation strategy. This document serves as the final exploitation plan, which is the result of a collaborative effort from all members of the ESRIUM consortium. This deliverable summarizes the results of the project (both exploitable results and knowledge results), background and foreground IPs, explains the individual exploitation plans, the joint exploitation plans, highlights the barriers to exploitation and evaluates the risks of exploitation. Finally, a set of recommendations by the HRB's experts concludes the document.

1.1. Objective of WP6

The objective of WP6 is to effectively spread knowledge and information about the project research and innovation outcomes and results. This WP consists of three tasks: communication and dissemination activities, engagement activities, standards and collaborations, and exploitation management and IPR (Intellectual Property Rights) strategy. Regarding the management of ESRIUM innovations, according to the Grant Agreement (GA), the key objectives are to:

- Analyses and follows relevant market developments, assessing the market potential for ESRIUM solutions.
- Develop and validate new business models based on ESRIUM outcomes.
- Drive technical developments towards business-relevant solutions, by providing coordinated feedback on business models viability and market take-up strategies to the other WP.
- Develop and support implementation of the Exploitation Plans for the ESRIUM solutions and technologies based on the Business Plan previously developed.
- Support the exploitation of knowledge assets developed in the project by the interested scientific and industry communities.

To achieve these objectives, T6.3 (exploitation management and IPR strategy) is further divided into two subtasks; commercial exploitation and knowledge exploitation. According to the GA, commercial exploitation (ST6.3.1) will be based on the business plan previously developed. This subtask prepares and plans for exploitation of the ESRIUM assets and knowledge, including:

- Participation in venture capital events to present the ESRIUM solutions to attract further funding after the completion of the project and reach our solution.

The knowledge exploitation subtask (ST6.3.2) prepares the exploitation of the valuable knowledge generated in ESRIUM for further research, consultancy, education, and policy decision-making. As part of this task, we have done the following activities.

- Design and assemble a comprehensive inventory of ESRIUM knowledge, including knowledge generated during implementation, specifications, and other results from the technological research activities. This activity will proceed throughout the project, inventorying the contents of relevant Deliverables as they are released.
- Involve all partners in the discussion, and final agreement, on which content in the knowledge inventory will be open for consultation and use by external parties. The partners' decisions on specific knowledge assets will comply with the IPR policy in the Consortium Agreement and will be consolidated at the end of the project.



1.2. Purpose of the document

The purposes of the final exploitation document are as follows:

- (I) Providing an updated overview of the exploitation strategies and progress made since the initial exploitation document and outlining any changes or updates made to the individual exploitation plans of partners.
- (II) To present the progress made by the project partners in implementing the methodology described in the initial exploitation document up to the end of the project, highlighting the achievements and contributions of each partner.
- (III) Reviewing the implementation of the methodology described in the exploitation handbook [26].
- (IV) Identifying any new joint exploitable results that have emerged since the initial exploitation document and proposing potential exploitation strategies for these results.
- (V) Developing and updating a business plan for joint exploitable results.
- (VI) Identifying any new potential barriers and risks to exploitation and proposing strategies for overcoming these obstacles.

1.3. Relationship with other tasks and deliverables

The present deliverable: Final exploitation plan-D6.7 is the last version of the initial exploitation plan in D6.6 [1], which has been the basis for this deliverable. This final report is highly tied to the ESRIUM use cases D2.1 [2], ESRIUM business case and ESRIUM business use cases D2.4 [3] and D2.5 [4], the market analysis D6.4 [5], and the ESRIUM Business Plan [6]. Moreover, other deliverables were continuously scrutinized to make sure that the foreground IP is identified on time and protection measures are taken.

Furthermore, over the course of the project, this document was being updated with the latest project achievements and contributions from all partners, which are being consolidated in this updated version at M36.

1.4. Dissemination level

This deliverable is classified as public though due to the nature of the inputs (it may contain confidential information or sensitive information related to the commercial and business-related applicability of the project foreground), two versions of the deliverable will be prepared, a full version available for the members of the ESRIUM consortium and a condensed version only including the exploitation handbook [26] intended for the public.

1.5. Structure of the document

The document is structured as follows:

- In Section 2, the methodology for the final exploitation plan is explained, putting emphasis on the second iteration of the 7-step ENIDE exploitation methodology.
- Section 3 is dedicated to IP management, where information about identified background and foreground IPs is provided, including specific limitations/conditions for implementation and for exploitation, as well as a brief description of each IP.
- In Section 4, an analysis of exploitable results is conducted by identifying potential commercialized assets and knowledge, classifying those assets, assessing the level of



technology readiness, studying the target customer/user, and the potential impact of the assets in the environment in which they operate.

- Section 5 focuses on outlining the final strategies and plans for exploitation at the individual partner level, which encompasses commercial assets and knowledge. It also addresses the barriers that may hinder the individual exploitation of the project's results.
- Section 6 intends to outline the project's joint exploitation roadmap, including the strategies considered, the joint exploitation plans, and a persona definition exercise to better understand ESRIUM's targeted groups.
- In Section 7, an analysis of potential barriers and risks to exploitation has been carried out including opinions and point of views of project partners regarding ESRIUM exploitation plans.
- Section 8 shows the results of using the three Horizon Result Booster services, which help in the development of ESRIUM's result exploitation strategy.
- In Section 9, the document concludes by summarizing the findings of the analysis conducted so far.
- Finally, Annex I includes some definitions of the joint exploitation strategies considered and Annex II, the persona profile definition by each target customer is included.

SECTION 2: METHODOLOGY

As we explained in Deliverable 6.6, the methodology we used was based on an agile and lean stepby-step methodology consisting of 7 key steps, as shown in Figure 1.



Figure 1: Stepwise Methodology.

Every step-in Figure 1 is linked to specific tasks and activities detailed in Figure 2, that shows the deployment of the stepwise lean approach in ESRIUM.







In D6.6, the ENIDE exploitation methodology was deployed using the Plan Do Check Act (PDCA) iterative design and management method. The planning stage involved providing partners with necessary methodology, metrics, and templates for homogeneous and effective exploitation plans, as well as guiding them in identifying proper exploitation strategies. An initial list of background IP was identified, and partners were provided with an IP inventory template to collect information about generated foreground IP. A comprehensive inventory of ESRIUM assets and knowledge was designed and assembled based on outcomes classified by their applicability. Business deployment scenarios were defined, initial exploitation strategies and plans were developed, and market analysis was conducted to better understand the ESRIUM business environment. Internal and external validation of the developed business scenarios was performed by conducting interviews with road operators and service providers, with results reported in D2.5 and D6.4. Feedback from these activities will be used to update exploitation strategies and bring improvements to the overall project outcomes.

In this deliverable, we delve into the second cycle of the ENIDE exploitation method, as indicated by the red circle in Figure 2. This cycle is pivotal in refining our exploitation approach. It encompasses a series of critical steps: firstly, we revisit and update the inventory of both background and foreground Intellectual Property (IP), ensuring our list is current and comprehensive. Next, we thoroughly assess IP protection measures, focusing especially on the newly identified foreground IP, to evaluate its patentability and industry applicability. This is followed by an update to our deployment scenarios, keeping them aligned with the latest market trends and innovations.

Furthermore, we continuously scout the market for emerging developments, ensuring our exploitation strategies remain relevant and effective. User feedback is solicited and integrated into validating our business model, ensuring it resonates with our target audience's needs and expectations. Lastly, we undertake a comprehensive review and refinement of our exploitation plan, ensuring it is robust and adaptable to changing market dynamics.

In line with our IP management protocols, we have conducted an in-depth analysis of the foreground IP protection measures. This involves assessing their suitability for patenting and their relevance in



the industry context. The process also includes an internal validation step, where we reach a consensus on which parts of our knowledge inventory are appropriate for external sharing and utilization. These decisions are made in strict adherence to the IP policy established in the Consortium Agreement (CA) and will be finalized as the project concludes.

In addition to these measures, our joint exploitation strategies have been solidified and agreed upon. This process involves updating the ESRIUM Business Plan, assessing the need for separate business plans for different segments, and planning our participation in venture capital events to attract post-project funding. We have also meticulously described various commercialization approaches, equipping our partners with the knowledge to choose the most effective strategy for exploiting our shared, valuable discoveries. A dedicated workshop was conducted to identify the most practical and preferred techniques for the entire consortium, fostering a unified approach to exploitation.

SECTION 3: IP MANAGEMENT

Leveraging the comprehensive IP management methodology outlined in the exploitation handbook [26], we have successfully pinpointed both utilized and newly generated Intellectual Property (IP). This section is specifically crafted to provide a detailed description of the identified background and foreground IP. Here, we not only enumerate these assets but also delve into their origins, characteristics, and the specific roles they play within the context of our project. This meticulous delineation ensures a clear understanding and effective management of these vital intellectual resources.

3.1. Background IP

At the initiation of our collaboration, concurrent with the signing of the consortium agreement, our partners had already pinpointed several key instances of background intellectual property (IP). In our ongoing efforts to keep our IP inventory current and comprehensive, we have recently revisited and updated this list. As a result, a total of 14 distinct background IPs have now been identified, with their specifics meticulously cataloged in the confidential version of this deliverable. We can provide a brief overview of background information:

- JRD limits distribution of their proprietary workflows but permits joint use through agreement. They provide tools for data analysis and services for producing detailed maps from survey data.
- ViF has control functions for cars that they utilize just and do not share; any additional access will be negotiated by them.
- GNSS networks, scanning equipment, and software tools are provided by FGI exclusively for project usage; they are not shared and are negotiable for further use.
- For project use, NNG makes navigation systems, libraries, and maps available; nevertheless, commercial exploitation necessitates fair conditions agreements or licensing agreements.
- For the project, EVO provides an AI predictive maintenance algorithm; any further commercial use is negotiable for offers at fair market value.

3.2. Foreground IP

The description o the identified foreground IPs can be found in the confidential version of this deliverable. Partners have identified 8 foreground IPs in total, including road wear map, trajectory estimation workflow, GNSS positioning latency impact assessment and mitigation, Infrastructure assisted ADAS/AD functions for lateral and longitudinal control of the automated vehicle, Predictive maintenance cycle and cost forecast Module, Road Wear Defect Detection and Road Wear data provisioning. Each of these foreground IPs has a direct connection to an existing background IP. In



such deliverable, we provide a comprehensive description of each IP. For ease of reference and clarity, background IPs in this table are denoted as ESR_BG. This designation facilitates a better understanding of the relationship between the newly identified foreground IPs and their corresponding background IPs.

The foreground IP for the project can be summarized as follows:

- The "Road Wear Map," "Trajectory Estimation Workflow," and "Road Wear Sensor System," which concentrate on mapping the road surface, sensor optimization, and defect identification, are among the advances that JRD leads.
- The GNSS location latency assessment and mitigation methods are part of FGI's contribution.
- VIF creates vehicle control functions with the help of the infrastructure.
- Predictive maintenance is what EVO does for road operators.
- Through a variety of protocols, NNG offers solutions for disseminating road wear data to stakeholders and end users.
- Every entry highlights a particular breakthrough associated with the project and lists the background intellectual property (IP) that either support or connect to these advancements.

SECTION 4: ANALYSIS OF EXPLOITABLE RESULTS OF ESRIUM

We have organized the project's outcomes into two distinct categories: assets and knowledge. To gather comprehensive data, we distributed a specially designed template to all partners. This template was instrumental in collecting detailed information about the assets developed throughout the project's lifecycle. It focused on several key aspects: the classification of each asset, its level of technological maturity, associated knowledge, target customer or user demographics, and the anticipated impact of each asset in its respective domain.

The findings derived from these inputs are systematically presented in the upcoming sub-sections. It's important to note that these inventories have undergone multiple updates to reflect the evolving nature of the project. The information we are sharing here represents the most current and relevant data regarding both the assets and knowledge amassed during the project. This approach ensures that we are providing an accurate and up-to-date snapshot of our project's tangible and intellectual achievements.

4.1. Inventory of assets

This sub-section is dedicated to compiling comprehensive information on the ten key assets identified within our project, with the objective of creating a detailed inventory. Each participating partner has contributed a significant asset essential to the project's development. These assets include, but are not limited to, road wear reference data, a road wear sensor system, software for road wear feature detection and classification, road wear map generation and management software, and infrastructure-assisted ADAS/AD functions.

To facilitate easy identification and reference, we have assigned a unique ID to each asset. These IDs commence with "ESR", an acronym for ESRIUM, followed by "ER", denoting an exploitable result. This systematic approach ensures clear and efficient categorization of the assets. Detailed descriptions of each asset, along with the information about the corresponding partner responsible for its development, are meticulously catalogued in Table 4. This structured presentation not only highlights the contributions of each partner but also provides a clear overview of the assets that form the backbone of our project.



ID	Org.	ASSETS	Description
ESR_ER_01	JRD	Road Wear Reference Data (Ground Truth Data)	Collection of ground truth data using the road wear sensor system.
ESR_ER_02	JRD	Road Wear Sensor System	The road wear sensor system will collect Road Wear Data (Images, Lidar, GNSS, etc.,) during measurement drives and upload the data to the detection and classification software.
ESR_ER_03	JRD	Road Wear Feature Detection and Classification Software	Algorithm developed based on the ground truth data
ESR_ER_04	JRD	Road Wear Map Generation and Management Software	Identified Road Wear Features will be aggregated into an up-to-date Road Wear Map which will be managed and made available by the management software.
ESR_ER_05	VIF	Infrastructure assisted ADAS/AD functions	The novel driving functions receive the information on the danger zones on the motorway along with recommended maneuver. The ADAS function then implements the recommended action, which in turn implies higher safety and comfort.
ESR_ER_06	EVO	Al software algorithm generates data to optimize maintenance schedules and estimate costs.	EVO creates an AI algorithm to calculate a predictive maintenance cycle and cost forecast. The AI algorithm calculates an extrapolation based on probabilities and provides recommendations for action.
ESR_ER_07	ASFINAG	Maintenance concept of recording road wear data by combining state-of - the -art technologies	A maintenance concept was created for combining the existing road wear data acquisition harness with a novel video-based harness and integrating these procedures into existing road operator procedures.
ESR_ER_08	NNG	Map-as-a-Service	NNG develops software to provide a map streaming service containing static and dynamic data elements following industry standards.
ES_ER_09	NNG	Road damage classification – extension for data delivery standards	NNG initiated the extension of TTI related data delivery standards with road damage description (eg. TPEG2, DENM, IVI, DATEX2, TMC).
ES_ER_10	FIG	Implementation of Galileo OSNMA protocol	The core SW has been implemented as a library. This library analyzes the signals originating from Galileo satellites and performs the authentication of the navigation messages from the Galileo constellation. The library has been designed for real-time and off-line use,



and can be integrated in third-party
applications.
Additional programs that use this library have
been created to monitor and analyze the
performance of OSNMA itself in terms of
different key performance indicators (KPIs),
and to make it possible the computation of
OSNMA-authenticated positions off-line using
several satellite-selection strategies.
The SW has been released as open source and
is therefore available to the whole
community/public.

Table 2: ESRIUM Inventory of Assets.

4.1.1. Classification of assets

To streamline the classification of assets, partners were provided with a comprehensive list of subject matter categories. This list included diverse classifications such as Hardware, Software, Scientific/Technical Information, Product Design, Firmware, Datasets (Text/Image), Database Models, Algorithms, among others. This categorization framework served as a guideline for partners to more precisely classify each asset.

The majority of the assets identified predominantly fall under the Software category, but there are also notable inclusions in Product Design and Business Model Innovation. Each asset has been thoroughly analyzed and its specifics, including its category, features, and other relevant details, are elaborately explained in Table 5. This structured approach ensures a clear and comprehensive understanding of the diverse range of assets developed within our project.

ID	ASSETS	Subject Matter
ESR_ER_01	Road Wear Reference Data (Ground Truth Data)	Software
ESR_ER_02	Road Wear Sensor System	Design of a product, Hardware, Software
ESR_ER_03	Road Wear Feature Detection and Classification Software	Software
ESR_ER_04	Road Wear Map Generation and Management Software	Software
ESR_ER_05	Infrastructure assisted ADAS/AD functions	Software
ESR_ER_06	Al software algorithm generates data to optimize maintenance schedules and estimate costs.	Software, algorithm
ESR_ER_07	Maintenance concept of recording road wear data by combining state-of -the -art technologies	Business Model
ESR_ER_08	Map-as-a-Service	Software
ES_ER_09	Road damage classification – extension for data delivery standards	Specification
ES_ER_10	Implementation of Galileo OSNMA protocol	SW implementing an openly available protocol.

Table 3: ESRIUM Assets Classification.



4.1.2. Maturity of assets

Understanding and assessing technology maturity is crucial for the progression of our project. In this section, we focus on the Technology Readiness Levels (TRLs) associated with each of the identified assets. We not only present their current TRLs but also outline the expected levels we aim to achieve in the future.

Technology Readiness Levels are categorized into nine distinct stages, ranging from the initial research phase to full deployment and commercialization. These levels begin at TRL 1, where basic principles and ideas are observed, and extend to TRL 9, which signifies that the system or product has been thoroughly tested and proven in an operational environment. By providing a clear overview of where each asset currently stands on this spectrum and our aspirations for their advancement, this section offers a comprehensive snapshot of the technological maturity and future potential of our project's key components.¹. Figure 3 details all the Technology Readiness Levels, from a research stage to deployment stage.



TECHNOLOGY READINESS LEVEL (TRL)

Figure 3: Technology Readiness Levels².

The assets we have identified are primarily situated at Technology Readiness Levels (TRLs) of 6 to 7. This classification indicates that these assets are in more advanced stages of development. At these levels, the assets have progressed beyond theoretical design and are in the phase of being demonstrated in relevant environments (TRL 6) or have been tested in an operational environment (TRL 7). The specific TRL for each asset, along with additional details about their current stage of development and implementation, is meticulously documented in Table 6. This table offers a detailed and informative snapshot of the advanced maturity levels of our project's key assets.

ID	ASSETS	Achieved TRL (M36)
ESR_ER_01	Road Wear Reference Data (Ground Truth Data)	6-7

¹ What are technology readiness levels (TRL)? Retrieved from <u>https://www.twi-global.com/technical-knowledge/faqs/technology-readiness-levels</u>



ESR_ER_02	Road Wear Sensor System	6-7
ESR_ER_03	Road Wear Feature Detection and Classification Software	6-7
ESR_ER_04	Road Wear Map Generation and Management Software	6-7
ESR_ER_05	Infrastructure assisted ADAS/AD functions	3-4
ESR_ER_06	Al software algorithm generates data to optimize maintenance schedules and estimate costs.	4-5
ESR_ER_07	Maintenance concept of recording road wear data by combining state-of -the -art technologies	1
ESR_ER_08	Map-as-a-Service	4
ES_ER_09	Road damage classification – extension for data delivery standards	3
ESR_ER_10	10 Implementation of Galileo OSNMA protocol	

Table 4: Maturity of Assets.

4.1.3. Target customer/user

Table 7 provides a detailed breakdown of the target customers and end users for ESRIUM's technological offerings. This overview reveals that Original Equipment Manufacturers (OEMs) and Road Operators consistently emerge as the primary customers for the majority of our assets. Additionally, for specific assets such as the Road Wear Map Generation and Management Software and Infrastructure-Assisted ADAS/AD Functions, vehicle end-users also represent a significant target market. Furthermore, for the latter asset, ADAS system developers present an intriguing opportunity as a potential customer group, offering another avenue for our technology's application and market expansion. This table effectively maps out our diverse customer base, showcasing the varied applicability of ESRIUM's innovative assets.

ID	ASSETS	Target customer/user
ESR_ER_01	Road Wear Reference Data (Ground Truth Data)	OEMs, Road Operators
ESR_ER_02	Road Wear Sensor System	OEMs, Road Operators
ESR_ER_03	Road Wear Feature Detection and Classification Software	OEMs, Road operators
ESR_ER_04	Road Wear Map Generation and Management Software	OEMs, Road Operators
ESR_ER_05	Infrastructure assisted ADAS/AD functions	OEMs, Road Operators, ADAS System Developers, Vehicle end-users
ESR_ER_06	Al software algorithm generates data to optimize maintenance schedules and estimate costs.	Road Operators
ESR_ER_07	Maintenance concept of recording road wear data by combining state-of -the -art technologies	Road Operators
ESR_ER_08	Map-as-a-Service	Road operators/vehicle drivers/fleet managers



ES_ER_09	Road damage classification – extension for data delivery standards	Road operators/Data service providers/vehicle drivers/fleet managers
ES_ER_10	Implementation of Galileo OSNMA protocol	All GNSS users requiring authenticated GNSS based geolocation.

Table 5: Target Customer for Each ESRIUM Asset.

4.1.4. Potential impact

The commercialization of ESRIUM's technology hinges on understanding the potential impact of each asset within its operational environment. The potential impact of ESRIUM's technology, as outlined in our analysis, centers on pivotal areas: enhancing road safety, optimizing maintenance operations, and reducing environmental impact. Our approach involves leveraging advanced data analytics and innovative software solutions to create safer, more efficient roadways. By focusing on accurate and timely data regarding road conditions, we aim to significantly reduce maintenance costs and CO2 emissions. Furthermore, the integration of these technologies into existing road infrastructure and vehicle systems underscores our commitment to not only advancing road safety but also to promoting sustainable and eco-friendly practices in road management and transportation. This overarching impact, as detailed in our comprehensive table, demonstrates the substantial value and far-reaching implications of ESRIUM's technological advancements. The specific impacts of each asset are comprehensively detailed in Table 8, which serves as a valuable resource in illustrating the broader implications of our technology.

ID	ASSETS	Potential Impact
ESR_ER_01	Road Wear Reference Data (Ground Truth Data)	An up-to-date road wear map can be used for keeping traffic safe (vision zero), decrease
ESR_ER_02	Road Wear Sensor System	costs for maintenance and reduce CO2 emissions.
ESR_ER_03	Road Wear Feature Detection and Classification Software	
ESR_ER_04	Road Wear Map Generation and Management Software	
ESR_ER_05	Infrastructure assisted ADAS/AD functions	Reduced risk to the vehicles, and reduced maintenance actions for the road operators
ESR_ER_06	Al software algorithm generates data to optimize maintenance schedules and estimate costs.	Saving on unnecessary maintenance work. Increasing the lifespan of the infrastructure.
ESR_ER_07	Maintenance concept of recording road wear data by combining state-of -the -art technologies	This concept aims to change that. The data update frequency could be brought down to once per day, thereby opening the market for vendors of video and other sensor types, as well as providing crucial input for a Road Wear Map-as-a-Service.
ESR_ER_08	Road Wear Map-as-a-Service	Currently no road wear data map service is available for safety purposes. NNG can provide regularly updated map layer that can be used by AD/ADAS. This would form part of a Digital Twin of the highway to finally enable services requiring dynamic aggregation of multiple road parameters.



ES_ER_09	Road damage classification – extension for data delivery standards	TTI will be able to convey road damage data to drivers. Thus drivers will have information about potentially dangerous raod damages ahead of their vehicles. Standardized data is needed to ensure interoperability and mass deployment.
ES_ER_10	Implementation of Galileo OSNMA protocol	The provided SW can be used to monitor the GNSS signals and detect spoofing (to some extent) in an area in the vicinity of a receiver. This is being incorporated in GNSS-Finland (see link below. The service will openly provide status information to any user and will automatically inform the pertinent authorities about the occurrence of spoofing events. Being the code openly available, other institutions, entities and particulars could also use it for spoofing detection and computation of OSNMA-authenticated PVT solutions. Thus, the provision of the SW contributes to the spreading and wide adoption of OSNMA. [1]- https://gnss-finland.nls.fi/

Table 6: Potential Impact of Identified Assets in ESRIUM.

4.2. Inventory of knowledge

Recognizing the importance of knowledge in driving project development, it's essential to create an inventory that captures the wealth of knowledge generated by each partner. Table 9 is designed to offer a comprehensive overview of this knowledge. It not only lists the knowledge outputs produced by each partner but also provides succinct descriptions of each partner's contributions to the project, along with the reciprocal benefits that the project has brought to their organization.

To facilitate easy tracking and reference, we have systematically grouped the knowledge results by partner. Additionally, each piece of knowledge has been assigned a unique identifier, beginning with "ESR" for ESRIUM, followed by "KR" to signify a knowledge result. This structured approach ensures that the rich tapestry of knowledge within our project is both clearly delineated and easily accessible, highlighting the collaborative efforts and mutual benefits realized through this project.

ID	Org.	Description	Target customer/user
ESR_KR_01	ENIDE	 ENIDE is leading the ESRIUM business case development, exploitation, communication, and dissemination activities in ESRIUM. Thus, we have acquired: new knowledge on road maintenance, the market for Road Asset Management (RAM), related technologies and business models, needs and requirements of stakeholders regarding ITS (Intelligent Transportation Systems) 	Other EU projects



		 More expertise in leading and 	
		management of EU funded projects	
		New contacts: we have been able to widen	
		our network and get connected to different	
		ITS stakeholders	
ESR_KR_02	FGI	FGI (in particular the Navigation and	Scientific community
		Positioning Department) takes care of the	Government agencies
		real-time positioning system for the end-user	Companies in the
		vehicle. This system is to comply with the	positioning field
		specifications from the project, in terms of	General society
		the constellation and signals to use, the	
		expected accuracy, and the use of OSNMA	
		from the Galileo constellation for	
		authentication. Due to this work, we have	
		acquired:	
		 More expertise in issues related to 	
		RTK-based positioning, in particular,	
		of platforms moving at considerable	
		speed (e.g., cars).	
		Considerable expertise related to the	
		OS-NMA service, which we have	
		implemented as a library.	
		New valuable contacts with project	
		partners.	
			- · · · ·
ESR_KR_03	VIF	VIF is responsible for testing and validation	Scientific community
ESR_KR_03	VIF	VIF is responsible for testing and validation tasks that are covered in WP5 of the project.	Scientific community OEMs
ESR_KR_03	VIF	VIF is responsible for testing and validation tasks that are covered in WP5 of the project. Particularly, VIF has developed prototype	Scientific community OEMs ADAS/AD System
ESR_KR_03	VIF	VIF is responsible for testing and validation tasks that are covered in WP5 of the project. Particularly, VIF has developed prototype automated functions that can be guided by infrastructure recommendations and	Scientific community OEMs ADAS/AD System developers
ESR_KR_03	VIF	VIF is responsible for testing and validation tasks that are covered in WP5 of the project. Particularly, VIF has developed prototype automated functions that can be guided by infrastructure recommendations and implemented these for demonstration on an	Scientific community OEMs ADAS/AD System developers General society
ESR_KR_03	VIF	VIF is responsible for testing and validation tasks that are covered in WP5 of the project. Particularly, VIF has developed prototype automated functions that can be guided by infrastructure recommendations and implemented these for demonstration on an automated driving development vehicle. In	Scientific community OEMs ADAS/AD System developers General society
ESR_KR_03	VIF	VIF is responsible for testing and validation tasks that are covered in WP5 of the project. Particularly, VIF has developed prototype automated functions that can be guided by infrastructure recommendations and implemented these for demonstration on an automated driving development vehicle. In doing so, VIF has acquired:	Scientific community OEMs ADAS/AD System developers General society
ESR_KR_03	VIF	VIF is responsible for testing and validation tasks that are covered in WP5 of the project. Particularly, VIF has developed prototype automated functions that can be guided by infrastructure recommendations and implemented these for demonstration on an automated driving development vehicle. In doing so, VIF has acquired: • Knowledge of EGNSS localization	Scientific community OEMs ADAS/AD System developers General society
ESR_KR_03	VIF	 VIF is responsible for testing and validation tasks that are covered in WP5 of the project. Particularly, VIF has developed prototype automated functions that can be guided by infrastructure recommendations and implemented these for demonstration on an automated driving development vehicle. In doing so, VIF has acquired: Knowledge of EGNSS localization methods and its utilization for 	Scientific community OEMs ADAS/AD System developers General society
ESR_KR_03	VIF	 VIF is responsible for testing and validation tasks that are covered in WP5 of the project. Particularly, VIF has developed prototype automated functions that can be guided by infrastructure recommendations and implemented these for demonstration on an automated driving development vehicle. In doing so, VIF has acquired: Knowledge of EGNSS localization methods and its utilization for vehicle applications. 	Scientific community OEMs ADAS/AD System developers General society
ESR_KR_03	VIF	 VIF is responsible for testing and validation tasks that are covered in WP5 of the project. Particularly, VIF has developed prototype automated functions that can be guided by infrastructure recommendations and implemented these for demonstration on an automated driving development vehicle. In doing so, VIF has acquired: Knowledge of EGNSS localization methods and its utilization for vehicle applications. Utilization of RTK-assisted EGNSS for 	Scientific community OEMs ADAS/AD System developers General society
ESR_KR_03	VIF	 VIF is responsible for testing and validation tasks that are covered in WP5 of the project. Particularly, VIF has developed prototype automated functions that can be guided by infrastructure recommendations and implemented these for demonstration on an automated driving development vehicle. In doing so, VIF has acquired: Knowledge of EGNSS localization methods and its utilization for vehicle applications. Utilization of RTK-assisted EGNSS for real-time vehicle positioning and 	Scientific community OEMs ADAS/AD System developers General society
ESR_KR_03	VIF	 VIF is responsible for testing and validation tasks that are covered in WP5 of the project. Particularly, VIF has developed prototype automated functions that can be guided by infrastructure recommendations and implemented these for demonstration on an automated driving development vehicle. In doing so, VIF has acquired: Knowledge of EGNSS localization methods and its utilization for vehicle applications. Utilization of RTK-assisted EGNSS for real-time vehicle positioning and control. 	Scientific community OEMs ADAS/AD System developers General society
ESR_KR_03	VIF	 VIF is responsible for testing and validation tasks that are covered in WP5 of the project. Particularly, VIF has developed prototype automated functions that can be guided by infrastructure recommendations and implemented these for demonstration on an automated driving development vehicle. In doing so, VIF has acquired: Knowledge of EGNSS localization methods and its utilization for vehicle applications. Utilization of RTK-assisted EGNSS for real-time vehicle positioning and control. Expanded knowledge on ADAS/AD 	Scientific community OEMs ADAS/AD System developers General society
ESR_KR_03	VIF	 VIF is responsible for testing and validation tasks that are covered in WP5 of the project. Particularly, VIF has developed prototype automated functions that can be guided by infrastructure recommendations and implemented these for demonstration on an automated driving development vehicle. In doing so, VIF has acquired: Knowledge of EGNSS localization methods and its utilization for vehicle applications. Utilization of RTK-assisted EGNSS for real-time vehicle positioning and control. Expanded knowledge on ADAS/AD function development. 	Scientific community OEMs ADAS/AD System developers General society
ESR_KR_03	VIF	 VIF is responsible for testing and validation tasks that are covered in WP5 of the project. Particularly, VIF has developed prototype automated functions that can be guided by infrastructure recommendations and implemented these for demonstration on an automated driving development vehicle. In doing so, VIF has acquired: Knowledge of EGNSS localization methods and its utilization for vehicle applications. Utilization of RTK-assisted EGNSS for real-time vehicle positioning and control. Expanded knowledge on ADAS/AD function development. Working knowledge of ITS-G5 	Scientific community OEMs ADAS/AD System developers General society
ESR_KR_03	VIF	 VIF is responsible for testing and validation tasks that are covered in WP5 of the project. Particularly, VIF has developed prototype automated functions that can be guided by infrastructure recommendations and implemented these for demonstration on an automated driving development vehicle. In doing so, VIF has acquired: Knowledge of EGNSS localization methods and its utilization for vehicle applications. Utilization of RTK-assisted EGNSS for real-time vehicle positioning and control. Expanded knowledge on ADAS/AD function development. Working knowledge of ITS-G5 communications and message 	Scientific community OEMs ADAS/AD System developers General society
ESR_KR_03	VIF	 VIF is responsible for testing and validation tasks that are covered in WP5 of the project. Particularly, VIF has developed prototype automated functions that can be guided by infrastructure recommendations and implemented these for demonstration on an automated driving development vehicle. In doing so, VIF has acquired: Knowledge of EGNSS localization methods and its utilization for vehicle applications. Utilization of RTK-assisted EGNSS for real-time vehicle positioning and control. Expanded knowledge on ADAS/AD function development. Working knowledge of ITS-G5 communications and message protocols. 	Scientific community OEMs ADAS/AD System developers General society
ESR_KR_03	VIF	 VIF is responsible for testing and validation tasks that are covered in WP5 of the project. Particularly, VIF has developed prototype automated functions that can be guided by infrastructure recommendations and implemented these for demonstration on an automated driving development vehicle. In doing so, VIF has acquired: Knowledge of EGNSS localization methods and its utilization for vehicle applications. Utilization of RTK-assisted EGNSS for real-time vehicle positioning and control. Expanded knowledge on ADAS/AD function development. Working knowledge of ITS-G5 communications and message protocols. First working real-life demonstration 	Scientific community OEMs ADAS/AD System developers General society
ESR_KR_03	VIF	 VIF is responsible for testing and validation tasks that are covered in WP5 of the project. Particularly, VIF has developed prototype automated functions that can be guided by infrastructure recommendations and implemented these for demonstration on an automated driving development vehicle. In doing so, VIF has acquired: Knowledge of EGNSS localization methods and its utilization for vehicle applications. Utilization of RTK-assisted EGNSS for real-time vehicle positioning and control. Expanded knowledge on ADAS/AD function development. Working knowledge of ITS-G5 communications and message protocols. First working real-life demonstration of infrastructure assisted automated 	Scientific community OEMs ADAS/AD System developers General society
ESR_KR_03	VIF	 VIF is responsible for testing and validation tasks that are covered in WP5 of the project. Particularly, VIF has developed prototype automated functions that can be guided by infrastructure recommendations and implemented these for demonstration on an automated driving development vehicle. In doing so, VIF has acquired: Knowledge of EGNSS localization methods and its utilization for vehicle applications. Utilization of RTK-assisted EGNSS for real-time vehicle positioning and control. Expanded knowledge on ADAS/AD function development. Working knowledge of ITS-G5 communications and message protocols. First working real-life demonstration of infrastructure assisted automated driving functions. 	Scientific community OEMs ADAS/AD System developers General society
ESR_KR_03	VIF	 VIF is responsible for testing and validation tasks that are covered in WP5 of the project. Particularly, VIF has developed prototype automated functions that can be guided by infrastructure recommendations and implemented these for demonstration on an automated driving development vehicle. In doing so, VIF has acquired: Knowledge of EGNSS localization methods and its utilization for vehicle applications. Utilization of RTK-assisted EGNSS for real-time vehicle positioning and control. Expanded knowledge on ADAS/AD function development. Working knowledge of ITS-G5 communications and message protocols. First working real-life demonstration of infrastructure assisted automated driving functions. New valuable contacts with project 	Scientific community OEMs ADAS/AD System developers General society



ESR_KR_04	FHO	FHO coordinated the use case definition and the non-technical requirement analysis. As a leading research institute for logistics and mobility research FHO has valuable methodological and domain-specific know- how and experience to efficiently lead and coordinate the use case requirement process. FHO will assess user acceptance of truck drivers on the one hand and of the traffic management on the other hand. To measure user acceptance, the technology acceptance model (Davis) is used. The main factors to be assessed are perceived usefulness and perceived ease of use of the solution. Furthermore, FHO contributes to all business-related tasks in ESRIUM. In doing so, FHO has acquired:	Scientific community National and international logistics and cooperative connected automated driving associations Infrastructure Operators OEMs General society
		 Knowledge on use case definition processes Knowledge on user requirements elicitation User acceptance assessment knowledge 	
ESR_KR_05	EVO	 Evolit is an individual software provider with a focus on infrastructure, mobility, and energy. With the project we expand: our knowledge and experience in the field of motorway operators win a reference project our skills for future similar challenges generate a potential future market 	Operators who need an extrapolation based on data changes, damage can develop over time. Any kind of infrastructure operator
ESR_KR_06	JRD	 JRD as the coordinator of the project will be responsible for the EGNSS/IMU selection, integration and processing for the sensor system, the test planning and execution for the user vehicle, the integration of the reference GNSS/IMU system into the user vehicle, the reference trajectory generation and evaluation of the EGNSS performance for both user vehicle and sensor vehicle, and the C-ITS communication performance analysis in terms of RTK age and accuracy. produce the ground truth data for Austrian test tracks and collect data with its own high class mobile 	Scientific community Government agencies Road Operators



		 mapping system "Leica Pegasus 2 Ultimate Dual Head". design, develop and calibrate a sensor system for the collection of road surface data, which consists of several cameras, one or more LiDAR sensors and a lower-cost EGNSS- enhanced inertial navigation system. help with the specification of map formats as well as for the design and development of the "Road Wear Data Aggregation and Management Layer". support in providing road damage data and HD map content early on and in appropriate formats to support the ADAS development. 	
		 expand our competence in the hardware setup for data acquisition (small and cheap solution) create a huge ground truth data set 	
		 for further usage develop a new highly sophisticated layer for our currently available HD maps 	
		 improve our EGNSS-based position algorithms resulting in higher accuracy than it is possible up to now 	
ES_KR_07	ASFINAG	ASF is a road operator offering its experience for consulting and its facilities for testing the concepts of ESRIUM.	ASFINAG would see itself being targeted by ESRIUM products
		In this project we aim to	
		• obtain an assessment of the viability	
		of setting up a road operator owned	
		system.	
		 obtain a comparison of business 	
		models to upgrade our system of	
		road wear data acquisition.	
		obtain a strategy for operating a dynamic	
EZB KB US	NNG	NNG is leading ESBILIM requirement	Drivers
L3N_KK_00	NING	specification and system design work	DINCIS
		package. It develops automotive software	Dynamic data
		and provides Location Based Services (static	aggregators, map
		and dynamic map data) for the software	makers
		developed.	
		with this project we can:	UEIVIS or fleet operators



 extend our dynamic data service portfolio and better implement HD map based LBS service portfolio. contribute to the development of industry and international standards to cover road wear data provisioning to increase overall road traffic safety assess new aspects of automated driving related service provisioning 	
enhance our connected service capabilities	

Table 7: Inventory of ESRIUM Knowledge.

SECTION 5: INDIVIDUAL EXPLOITATION ROADMAP

The development of the ESRIUM project involves a series of intricate steps and strategies, as comprehensively detailed in the exploitation handbook [26]. This handbook has been a pivotal guide for our partners, providing a structured approach to developing their respective exploitation strategies. The planning process is divided into two main streams: partner-level exploitation strategies and joint exploitation strategies and plans.

In this section, we concentrate on the individual exploitation plans at the partner level, specifically tailored for both commercial/assets and knowledge results within the ESRIUM project. The structure of the planning process is twofold: it encompasses the development of partner-specific strategies for commercial exploitation, which focus on the assets created, and strategies for knowledge exploitation, which center around the valuable insights and information generated during the project. By presenting both the commercial and knowledge exploitation aspects, we provide a holistic view of how each partner intends to utilize and maximize the potential of their contributions to the project. This approach not only underscores the diverse capabilities and resources within the consortium but also highlights how these individual strategies collectively contribute to the success and impact of the ESRIUM project.

5.1. Individual Commercial Exploitation Plans

ESRIUM has established all-encompassing plans for utilizing its technology resources in a range of fields. In the confidential version of this deliverable, we provide specifics of the commercial exploitation plans for each one of the assets comprising ESRIUM's technology.

These plans, which attempt to maximize each asset's potential for commercialization and market entry, include both short- and long-term objectives.

For the short term, the emphasis is on

- establishing fundamental components such technological integration, data validation, and algorithm improvement.
- forming alliances, starting joint ventures, and raising the bar for technological preparedness.
- developing service offerings, licensing structures, and specialized solutions suited to certain industry requirements.

Long-term, the plans change to focus on:

- reaching a wider audience, bringing products to market, and setting solutions apart as industry standards.
- promoting industry standards, increasing technical stability, and strengthening interaction with the current infrastructure.



• utilizing achievements to seize new chances, enhancing software features, and steadily enhancing algorithms.

Overall, the goals of these plans are to take advantage of new technology, create strong business plans, and guarantee steady expansion through product development, market expansion, and industry partnerships.

5.2. Knowledge Exploitation Plans

As explained before, each partner has contributed to the project with their expertise and knowledge. This section reflects the planning of each partner to exploit their knowledge. More detailed information can be found in the confidential version.

In this section we provide an overview of the short- and long-term plans:

Short-term plans

- Engagement in Projects: Following the ESRIUM project, organizations seek for and take part in EU-funded research and innovation projects that correspond with their areas of expertise.
- Consultancy Services: By focusing on companies and organizations associated with the project's focus areas, they intend to broaden their consulting offerings by utilizing the technical know-how and insights they have gained from ESRIUM.
- Research and Knowledge Consolidation: Building on acquired knowledge, the main objectives are to expand networks, increase visibility and trust, and continue research toward strong and resilient technologies.
- Visibility and Dissemination: Organizations hope to become more well-known in both domestic and global circles, share project outcomes, incorporate learning opportunities into educational initiatives, and improve their capacity to respond to new scientific inquiries.

Long-term plans

- In charge of research projects: taking the lead and making a significant impact on research and innovation projects supported by the EU that are focused on market and technological innovation.
- Market expansion and client connections: Putting strategic plans into action to achieve steady market expansion through fostering enduring client relationships, venturing into new markets, and spotting chances to use knowledge.
- Technological Advancements: Promoting the creation of cutting-edge technical solutions that expand and enhance ESRIUM's capabilities with the goal of making these products the industry leaders in their respective fields.
- Consolidating Expertise and Cooperation: Maintaining and developing expertise by means of continuous research, participation in important initiatives, tight cooperation with academic and industry partners, and ongoing area growth.

Building on the groundwork established by the ESRIUM project, these long-term strategies seek to strengthen and broaden their positions in research, market expansion, technology innovation, and industrial partnerships.



5.3. Barriers to Individual Exploitation of Results

Before implementing the exploitation strategies mentioned above, an analysis of potential barriers to exploitation must be taken into consideration in order to have a better understanding of obstacles during the process. In this section we have compiled partner's opinions and point of views regarding ESRIUM's market and environment. We have classified the barriers identified as: financial barriers, industrial engagement, data challenges, regulatory and standardization barriers, market and solution alignment, communication and compatibility issues, Intellectual Property Rights (IPR) issues, academic involvement, existing contracts, and liaison problems.

Financial barriers: Significant financial barriers stand in the way of different partners' attempts to take advantage of findings and expertise. Their capacity to innovate and create novel solutions is hampered by this restriction, which takes the form of inadequate funding for research and development initiatives. Without enough funding, partners might find it difficult to make the investments in technology, research, and resources needed to commercialize their ideas. This barrier can seriously obstruct innovation and advancement in several fields.

Industrial Engagement: Industrial participation is essential to the effective use of findings and information. Nevertheless, some organizations have trouble attracting the attention and backing of important industry participants like highway operators and original equipment manufacturers (OEMs). Without solid industrial relationships, it may be difficult to secure the support, funding, and knowledge needed to move projects ahead. This lack of assistance might also be a symptom of more serious problems with knowledge and abilities, which are necessary for creating and putting into practice creative solutions.

Data challenges: A key element of many contemporary technologies is data, particularly those that deal with artificial intelligence and data-driven decision-making. This group of challenges includes problems like inadequate data availability and low-quality data. The ability to design and evaluate solutions is hampered by the lack of appropriate data, especially in data-intensive sectors. The accuracy of algorithms and decision-making processes can be compromised by poor data quality, which is characterized by mistakes and missing data categories, producing less than ideal outcomes.

Regulatory and standardization barriers: One significant barrier to exploitation is the presence of regulatory obstacles. Laws, regulations, and policies that hinder exploitation or make it difficult to launch new goods or services are examples of regulatory hurdles. Furthermore, interoperability can be hampered by non-standard hardware and software, which makes it challenging for various systems and devices to function together efficiently. This lack of uniformity may cause incompatibilities and inefficiencies.

Market and solution alignment: The mismatch between available solutions and market needs is a major obstacle in this category. Successful exploitation requires an understanding of and response to the unique needs of the market. Limited adoption and acceptance by the market might result from a mismatch between what the market requires and what a solution offers. This alignment is made more difficult by the different ways that OEMs and highway operators take, which could lead to fragmented and inconsistent solutions.

Communication and compatibility issues: Technical barriers such as compatibility and communication problems can make it difficult to successfully implement results. The reach and efficacy of services or solutions might be restricted by inadequate communication coverage, particularly in rural or difficult environments. Onboard device incompatibilities might hinder new technology adoption and cause integration issues.

Intellectual property rights (IPR) issues: Legal and contractual impediments to exploitation can be created by intellectual property rights (IPR) concerns. Intellectual property ownership, protection,



and licensing can provide obstacles for organizations. The exploitation process may be hampered by these problems if they result in disagreements, hold-ups, or even legal action.

Academic involvement: Certain organizations have challenges related to students' disinterest in conducting research on particular subjects. This obstacle may make it more difficult for academic institutions to draw in talent and funding for research and development, which could limit their capacity for innovation.

Existing contracts and liaison issues: Partners' ability to implement new technologies or solutions may be constrained by contracts they currently have for particular services or solutions. Liaison problems between various divisions within an organization can also result in coordination problems, which impede the process of exploitation. Last but not least, the reluctance of automakers to use certain technology (i.e., RKT) can make it difficult to bring innovative products to market.

In conclusion, all of these barriers stand for the difficulties that partners have when trying to provide novel solutions to the market. In order to successfully exploit new technologies and information in a variety of areas, promote innovation, and ensure their effective acceptance, it is imperative that these hurdles be addressed. In order to successfully traverse the exploitation process and create strategies that address these challenges, companies must have a thorough awareness of these hurdles. This will ultimately pave the way for successful exploitation and market adoption.

More details can be found in the confidential version of this deliverable.

SECTION 6: JOINT EXPLOITATION ROADMAP

This section provides an in-depth analysis of the joint exploitable results of the ESRIUM project, and delves into the joint exploitation strategies that were considered by the partners. A significant focus is placed on the collective decision-making process regarding the continuation and further exploitation of these results after the project's conclusion. It has been determined that the partners will engage in a follow-up project to enhance the joint results and achieve a higher Technology Readiness Level (TRL). Additionally, this section introduces a comprehensive business plan, developed in response to the recognized commercial potential of the ESRIUM joint exploitable results. Despite the high current TRL and the decision to further develop these results in a subsequent project, a well-structured plan for market entry is deemed essential. This approach reflects a strategic foresight to not only continue the advancement of these results but also to prepare for their successful introduction and adoption in the market.

6.1. Joint Exploitation Strategies Considered

This section comprehensively details the journey of the ESRIUM project's commercialization efforts, beginning with the initial strategies laid out in Deliverable 6.6: Preliminary Exploitation Plans.

On November 29, 2022, the ESRIUM consortium gathered in Graz for an Innovation Committee Meeting that coincided with a Consortium Meeting. A key agenda of this meeting was a workshop dedicated to evaluating and deciding on the most effective exploitation strategies for the joint exploitable results of the project. This workshop was not only pivotal in aligning the partners' perspectives but also instrumental in charting the future course of action for the commercialization of the project's outcomes.

During this workshop, various commercialization strategies were scrutinized. The consortium examined both direct and indirect routes to market entry – direct involving a consortium partner and indirect involving third-party entities. This analysis took into consideration the unique protection policies of each asset and the strategic objectives of the owning entities. Reflecting the diverse nature of the ESRIUM consortium, which includes both RTOs and for-profit organizations, five relevant



commercialization channels were identified. These channels were selected based on their alignment with the goals integrated into the respective intellectual property strategies of each partner.

A brief description to each one of them is detailed in Annex II based on the work carried out by IPR Helpdesk of European Commission³,⁴:



Figure 4: Exploitation Channels Considered.

The decision-making process was democratic, with partners voting on the proposed strategies. It became evident that to achieve a higher level of technological maturity, continued research and development were essential. The group thus agreed that the most effective strategy would be to pursue a follow-up project, aimed at scaling the ESRIUM solutions for a broader market application.

Proposed strategy	JRD	NNG	ASF	EVO	ENI	FHO	VIF	FGI
Joint Venture				х	х		х	
Spin off							х	
(Third party) exclusive Licensing					х			
(Third party) Non-exclusive licensing			х		х		х	
Tender			х					
Follow-up project	x	Х	х	х	х	x	x	x

Table 8: Vote on Each Proposed Strategy.

³ Fact Sheet - Exploitation channels for public research results (2014), European Commission, European IPR Helpdesk. Retrieved from: https://www.um.es/documents/2096502/4912353/Exploitation_channels_for_public_research_results_0.pdf/f73caab5-e935-4988-a449-3c0fdaf6b160

⁴ Your Guide to IP Commercialisation (2019), European Commission, European IPR Helpdesk. Retrieved from: https://intellectual-propertyhelpdesk.ec.europa.eu/system/files/2021-02/EU-IPR-Guide-Commercialisation-EN%283%29.pdf;



This led to the submission of a follow-up project proposal, ESRIUM LS, under the HORIZON-EUSPA-2022-SPACE-02-51 call, with a deadline on March 9th. Despite the proposal not being accepted for funding, the consortium remains steadfast in its commitment to finding alternative funding avenues. The overarching goal is to ensure the continuation of the project through large-scale demonstrations that can further validate and refine the technology.

The ESRIUM-LS project is ambitiously planned to extend the current project's technical results, targeting a system maturity of TRL 8. This involves monitoring over 4000 km of road lanes, engaging multiple sensor systems, and managing data aggregation on a central platform. This project is not just about technological advancement; it's also about standardizing road damage categories and data distribution formats across Europe, contributing significantly to the sector's standardization efforts.

While the consortium is proactive in seeking alternative funding for ESRIUM-LS, a business plan [6] has been developed to exploit the current project's results. This plan addresses the immediate commercial potential of the ESRIUM solutions as they stand today, ensuring that the current technological advancements are not left untapped. Furthermore, the consortium is actively engaging with potential commercial partners. Meetings with key industry players like Yunex, TomTom, and Here signify the project's market readiness and the consortium's dedication to bringing the ESRIUM solutions to the market.

6.2. Joint Exploitation Plans

In collaboration with the experts from Horizon Result Booster, the ESRIUM consortium has meticulously developed a comprehensive exploitation roadmap. This roadmap outlines a detailed strategy that encompasses actions, partner roles, milestones, financials, and the expected impact in the three to six months following the project's conclusion. The consortium unanimously agreed to initiate a follow-up project named ESRIUM-LS, aiming to elevate the technology to a higher Technology Readiness Level (TRL) and cater to a broader market. This decision was made after an extensive evaluation of various commercialization approaches for the project's results.

Despite the initial proposal for ESRIUM-LS not securing funding, the partners remain undeterred and are actively exploring new calls for proposals to continue the advancement of the ESRIUM solution. The scope of this ambitious project extends beyond mere technical development and implementation. It encompasses a range of critical tasks including revising the business plan, safeguarding intellectual property, and identifying viable public funding avenues.

Additionally, the consortium plans to explore the potential for policy influence to facilitate the commercialization of ESRIUM. A key goal is to advance the technology to TRL 8 and engage with thirdparty entities to broaden the project's impact. The collective efforts of the involved parties, which include JRD, VIF, EVO, ASFINAG, NNG, and ENIDE, are poised to deliver significant societal benefits. These include enhancing the efficiency of road maintenance, creating job opportunities, and contributing to the development of more sustainable and effective transportation networks.

This roadmap serves as a strategic guide, ensuring a seamless transition for the project into its next phases of research, development, and market implementation. It embodies the consortium's commitment to advancing the ESRIUM project's outcomes and making a tangible impact in the realm of road infrastructure and transportation.

More details about the joint exploitation plans can be found in the confidential version of this deliverable.

6.3. Persona Definition

By giving a client segment a face and name, the persona canvas can help put project's partners in the customer's shoes. Personas facilitate the discussion of consumers and their attributes by providing a



more specific and tangible framework, as well as an easier way to revisit a pattern of attributes. Personas enable the creation and exchange of mental models as well as a common language about various consumer categories.

As it will be mentioned in Section 8, the services of HRB were useful to identify different personas for the main target customer. This exercise was conducted in a wokrshop with project's partners, were each partner solved the persona canvas for specific target customers.

The persona definition with those companies was identified by partners, following the persona definition canvas [25]:



Figure 5: Persona Profile Canvas [25].

These persona definitions offer a thorough grasp of the needs, preferences, and pain points of the important players in the target organizations. By using this data, marketing and communication tactics can be more successfully tailored to engage and convert these personas.

After analyzing the canvas for the personas, we defined 3 main areas to understand better our target customer: pain points + what they don't want, solutions they might be interested in and why they would buy from us (ESRIUM solution). The persona definitions are summarized as follows:

Persona 1 (Map Suppliers): This person is an expert in mapping, domain knowledge, and innovation management. They are a map supplier. They are proficient in standards, market research, and national and EU funding plans. They are risk-takers by nature, highly influential, and willing to take calculated chances. Their problems include high mapping expenses when they try to switch from proprietary mapping to open-source alternatives, and a lack of knowledge about new technologies and methodologies that causes an information lag. They are looking for creativity, knowledge of the most recent mapping and localization initiatives, experience, and proof of results. They can be drawn to ESRIUM by its competitive cost, fast, accurate, and high-quality data, as well as by its exclusive data.

Persona 2 (OEMs): This persona works in the innovation division of an OEM as a CCAM Expert. They are enthusiastic about innovation and provide a wealth of knowledge in fields like automated driving and C-ITS. Naturally risk-takers, they must persuade internal production department specialists of



the benefits of innovation. Their biggest complaint is the lack of innovative ideas and information. They look for data on innovation elements, time-to-market, expertise, Technology Readiness Level (TRL), and integrability into their manufacturing processes in order to meet their needs. With chances for open innovation and the ability to incorporate ideas into their manufacturing processes, ESRIUM can win them over.

Persona 3 (Technology company): This person has a wealth of experience in sensor technology, artificial intelligence (AI), localization, and mapping in their roles as Chief Technology Officer (CTO) and technical development. They have a strong enthusiasm for technology and are risk-takers and inventors. The lack of resources for innovation is their main problem. As such, they are keen to explore the intricacies of sensor technology, artificial intelligence, localization, and mapping. They look for experience and proof of influence or outcomes. ESRIUM may captivate this character by offering expertise in their areas of interest and a dedication to quality, accuracy, and speed.

Persona 4 (Commercial 3rd Party): This character works in sales and has a wide network while being receptive to new ideas. They pay special attention to product portfolios, sales tactics, and sales processes. Persuading clients and navigating cycles of product innovation are their main problems. They are eager to learn about ESRIUM's unique selling proposition (USP), as well as cost, impact, and outcomes, in order to tackle these difficulties. With complementing solutions that can be included into their product line, boost sales volume, and improve competitiveness, ESRIUM may draw them in. Two other crucial elements are competitive prices and a dedication to quality.

Persona 5 (Road Operator and International Association Member): This person is a technical team leader with expertise in association work, national and international R&D projects, and traffic management. In the fields of ITS and CCAM, they are trailblazers and technological authorities. The absence of C-ITS use cases and evidence-based impact are their primary complaints. They look for information regarding project partners, effect, and outcomes in their search for creative solutions. In order to engage them, ESRIUM can highlight its dedication to accuracy and quality, which will support C-ITS installations, as well as its experience and possible influence on solutions.

Persona 6 (Road Operator): This persona, who is a technical team leader, is excellent at asset management and has a cautious approach. Managing asset-related concerns and resource limits are their main challenges. They are eager to investigate cutting-edge approaches and intricate aspects pertaining to asset management in order to tackle these obstacles. Inquiries concerning project partners, impact, and outcomes are also sought after. By offering superior solutions and knowledge catered to their asset management requirements, ESRIUM may draw them in. It would be quite desirable to have solutions that fit in with their procedures seamlessly.

To conclude, it is essential to comprehend the distinct characteristics, problems, and expectations of every persona in order to properly customize your marketing, communication tactics and exploitation strategies. ESRIUM should concentrate on proving how its solutions meet these particular objectives, delivering measurable outcomes, and earning the trust of these important figures in the target organizations. This analysis has been the basis of the updated version of the business plan, which we highlighted the problems, solutions offered and unique value propositions for these personas.

6.4. ESRIUM Business Plan

In any case, the joint exploitable results developed during the current project can be indeed exploited as a whole solution without any further features (i.e., what will be developed in ESRIUM L-S) given that all components are expected to reach high TRLs (between 4 and 6) proving the commercial potential of the joint exploitable results; hence, a business plan was needed for the proper exploitation of the joint results.



The confidential version of this deliverable, which aims to detail the plan for commercializing ESRIUM joint exploitable results, starting by describing the nowadays problems in the road infrastructure management systems and how ESRIUM will tackle these issues. We will also describe the features and product offerings of ESRIUM that is made up of several technical components that combine to offer a complete road wear management solution. The ESRIUM value chain, which consists of the Data Management Platform, Road Wear Sensor System, Road Wear Map Processing System, Road Wear Prediction System, as well as the Data Users. The various ESRIUM components that can be sold as products or services are described. Following, we will list the project's stakeholders and divide them into two categories: direct and indirect stakeholders. Then, the plan provides a market analysis which details the target market, market size, drivers, and trends. Also, a competitive analysis followed by a description of the ESRIUM innovation, and its unique selling point is detailed. The ESRIUM business model, cost structure, pricing strategy and a financial forecast for the first five years after commercialization is detailed in the remaining subsections.

It is important to note that the base for this section are the deliverables 2.5 [4] and 6.4 [5] where the ESRIUM business case and an extensive market analysis was conducted, as well as the persona definition workshop held in October of this year.

SECTION 7: BARRIERS, RISKS AND MITIGATION ACTIONS

In this section, we will discuss the potential risks and barriers to the successful exploitation of the ESRIUM project's results. It is important to identify and assess these risks in advance to ensure that appropriate mitigation strategies are in place to minimize their impact on the project's success. By addressing potential risks and barriers, the ESRIUM project team can maximize the project's impact and ensure that its outcomes are effectively exploited to benefit society and the project's stakeholders. Based on the ESRIUM Business Plan [6], we will present the analysis of risks with their respective mitigation strategies.

7.1. Barriers

Before implementing the exploitation strategies mentioned above, an analysis of potential barriers to exploitation must be taken into consideration in order to have a better understanding of obstacles during the process. In this section we have compiled partner's opinions and point of views regarding ESRIUM's market and environment.

Technical obstacles are a significant concern, especially those pertaining to the technology that powers the entire ESRIUM system. The availability and quality of data, for example, may provide difficulties as it is necessary for the AI prediction system to work. A major barrier to the effective commercialization of the full ESRIUM solution may be inadequate or low-quality data. Furthermore, problems could arise from incompatibilities between various system components brought on by a lack of recognized standards.

Furthermore, traditional value chains, which are often less inventive, may oppose ESRIUM's new character as an AI-driven solution. The integrated solution's commercialization may also be hampered by legal and compliance requirements.

Since different partners within our consortium are research institutes or other companies without extensive marketing experience or a defined commercialization strategy, some of our partners might not have commercialization as their major emphasis. This might make it more difficult for them to make a meaningful contribution to the marketing of the entire ESRIUM solution. Lack of experience managing intellectual property rights, which is essential when working with an all-inclusive system like ESRIUM, is another possible obstacle.



It is important to keep in mind that the ESRIUM solution's commercial exploitation may be restricted by any inconsistencies between the needs of the market or operators and its capabilities. Although this danger has been recognized, more market research is necessary to determine whether it will actually occur.

These barriers have been formerly analyzed in D6.6 Deliverable 6.6: "Preliminary Exploitation Plans" [1]. We will continue to assess risks impacting the project and the corresponding mitigation plans in Section 7.2.

7.2. Specific Risks and Mitigation Plans

According to the PMI, a risk is an "uncertain event or condition that, if it occurs, has a positive or a negative effect on a project's objectives" (PMBOK, 2017) ⁵. Understanding risks can assist in determining how to apply effort and resources to enhance the chances of project success. Day-to-day project risk management focuses on these risks in order to enhance the prospects of a successful project outcome (PS PRM, 2009)⁶. The ESRIUM project is a forward-thinking endeavor that strives to commercialize novel technologies in the market, that seeks to revolutionize the way we approach road safety and resource efficiency. However, there are a number of risks involved with the project that must be examined and handled in order for it to succeed.

To conduct the analysis of potential risks associated with the ESRIUM project, the following steps were followed:

- 1. Identify the potential risks;
- 2. Assess the risks found, considering the level of importance, relevance of likelihood of occurrence, and possible mitigation strategies;
- 3. Input the risks into the risk matrix to prioritize and treat them.

We will look at some of the specific risks involved with the ESRIUM project and describe mitigation options. In Section 7.3 will present the matrix of risks encountered.

The risks facing an organization and its operations can result from factors both external and internal to the organization⁷.

One of the primary risks associated with the ESRIUM project is the **potential for spinoffs and startups to emerge**, increasing competition and diminishing the market for the project's technology. While the development of a robust, accurate, and up-to-date road wear map has the potential to revolutionize the way road operators manage and maintain their networks, it is also a highly specialized and technically complex field. As such, there is a risk that other companies or organizations may seek to replicate or build upon the ESRIUM technology, potentially creating competing offerings which could divert market share and diminish the influence of the original innovation. The importance of this risk is high. The ESRIUM project requires a substantial investment of time and money, and its success is important to the safety and efficiency of road networks throughout Europe and beyond. The relevance is moderate. While the possibility of spinoffs and startups is a constant issue for every innovation-driven initiative, the ESRIUM technology's highly specialized nature makes this risk considerably more severe. The likelihood of this risk is moderate. While it is hard to tell whether other firms or groups would seek to imitate ESRIUM technology, at least some level of competition is expected to arise in the market. To mitigate this risk, the ESRIUM

⁵ Merei, A. A. (2021, January 19). PMP Project Management Professional Strategy: A Guide to the Project Management Body of Knowledge (PMBOK Guide) 6th Edition.

⁶ Institute, P. M. (2019, April 22). The Standard for Risk Management in Portfolios, Programs, and Projects.

⁷ FERMA. (2011). A Risk Management Standard (English version)



project team will develop a robust intellectual property strategy that protects the technology and its associated data. This strategy will include securing patents and other forms of legal protection for the road wear map and its underlying technology, as well as identifying and partnering with organizations that share the ESRIUM team's long-term vision for the future of mobility. By collaborating with trusted partners who are committed to the same goals, the ESRIUM project can ensure that its technology is deployed in a way that maximizes its impact while minimizing the risk of competition.

Another significant risk is the **complexity of commercialization with different partners**. As a project with numerous stakeholders, ESRIUM requires careful coordination and collaboration among a diverse array of organizations, each with its own priorities, objectives, and expectations. This complexity can lead to delays, miscommunications, and other logistical challenges that can hinder the project's progress and reduce its impact. The importance of this risk is high. The ESRIUM's commercialization success is dependent on the successful collaboration and alignment of a vast number of stakeholders, each with its own set of interests and goals. The relevance is very high. This risk is high due to the project's multinational structure and the complicated network of relationships necessary to bring the technology to market. Also, the likelihood is high. Given the project's complexity and scope, it is likely that there will be coordination, communication, and alignment issues among partners. To mitigate this risk, the ESRIUM project team should develop a comprehensive partnership agreement that outlines each partner's roles, responsibilities, and expectations in regard to commercialization. In addition, the ESRIUM team will work closely with each partner to identify and address any potential logistical or communication challenges that may arise and will maintain open lines of communication throughout the project to ensure that issues are addressed promptly and effectively.

A third risk is that the **technology will not be widely adopted or will be seen as too sophisticated.** This risk is considered to be of moderate importance and relevance, with a moderate likelihood of occurrence. To mitigate this risk, the project team must conduct extensive market research to understand the needs and priorities of potential customers and stakeholders. They must engage with industry experts and thought leaders to build awareness and support for the technology. The team must also work to ensure that the technology is accessible and easy to use, and that it provides clear benefits to users.

Another risk that ESRIUM will confront is the possibility of **unforeseen difficulties throughout the development and commercialization processes**. This risk is considered to be of high importance and relevance, with a high likelihood of occurrence. To mitigate this risk, the project team must develop a robust business plan that includes contingencies for potential challenges and risks. They must maintain strong communication and collaboration with all partners to ensure that any issues are addressed promptly and effectively. Additionally, the team must be flexible and adaptable, able to pivot quickly in response to changing circumstances.

Another risk that could impact the ESRIUM project is **the emergence of competing technologies or solutions**. The market for digital mapping and road wear information is becoming increasingly crowded, and there is a risk that a competitor could emerge with a similar or superior solution, disrupting ESRIUM's business model and revenue streams. The importance of this risk is high, as competition can have a significant impact on the success of a business. The relevance of this risk is also high, as there is already a lot of competition in this field, and it is likely to increase as digital mapping and autonomous driving become more widespread. The likelihood of this risk is moderate, as it is difficult to predict when a competitor could emerge or what their solution might be. To mitigate this risk, the project team must focus on creating a unique value proposition that differentiates it from competitors. This could involve developing new features or capabilities that are not offered by other digital mapping solutions or partnering with other companies to create new offerings. ESRIUM can also invest in marketing and branding efforts to build brand recognition and



customer loyalty. By building a strong brand and reputation, we can increase customer retention and reduce the risk of losing market share to competitors.

A further risk that could impact on the ESRIUM project is the **lack of adoption or interest from potential customers**. While the benefits of the road wear map are clear, it may take time for customers to understand and appreciate its value. This risk is important as the success of the ESRIUM project is dependent on widespread adoption by customers. The relevance of this risk is also high, as customer interest is a key factor in driving revenue and growth. The likelihood of this risk is moderate, as the road wear map is a new and innovative solution that may take time to gain traction. To mitigate this risk, the project team can focus on educating potential customers about the benefits of the road wear map. This could involve targeted marketing campaigns, outreach to industry groups, or speaking engagements at conferences and events. It could also work to build relationships with key stakeholders and influencers in the industry, such as government agencies, trade associations, and industry thought leaders. By building relationships and educating potential customers, ESRIUM can increase awareness of the road wear map and drive adoption.

The risk of **not reaching an agreement** pertains to the possibility of the ESRIUM commercialization failing to obtain the necessary approvals from stakeholders, such as road operators, to proceed with the project. This risk holds high importance as securing stakeholder agreements is critical to the success of the project. Additionally, stakeholder agreements are necessary for the project to move forward, making this risk highly relevant. The likelihood of this risk is moderate as obtaining stakeholder agreements is crucial, but with effective stakeholder engagement and addressing their concerns, the risk can be mitigated. To mitigate this risk, it is crucial to involve stakeholders early on and maintain regular communication with them. The project team should build a strong communication strategy to keep stakeholders informed of the project's progress and handle any difficulties that may occur, as well as to answer any concerns or requests that stakeholders may have.

The risk of **fair IP compensation** refers to the potential for stakeholders involved in ESRIUM to not agree on fair compensation for the intellectual property (IP) rights associated with the technology. This risk has a medium likelihood, but high importance and relevance, as fair compensation for IP is crucial for the success of the project. To mitigate this risk, several strategies can be implemented. The project stakeholders can negotiate and agree on fair compensation terms for IP rights associated with ESRIUM technology upfront to reduce the likelihood of disputes later. The project can also keep detailed documentation of all IP ownership and agreements among stakeholders to mitigate disputes over IP ownership. Another mitigation strategy is to establish a neutral third-party mediator who can be brought in to help reach an agreement that is fair for all parties involved in the event of a dispute over IP compensation. Contracts can also include clauses that outline the process for determining and resolving disputes over IP compensation. Finally, the project can stay informed about changes in IP laws and regulations that may impact IP compensation, which can help prevent disputes and ensure fair compensation.

The risk of **lack of funding** refers to the possibility that the ESRIUM project may not receive enough financial resources to achieve its objectives and complete its activities. This risk could lead to delays in project activities, reduction of project scope or even project termination. Additionally, a lack of funding could impact the quality of the project's deliverables, which may negatively affect the project's reputation and success. The importance of addressing this risk is high, as a lack of funding could compromise the objectives, scope, quality, and reputation. The relevance of this risk is also high, as funding is crucial for success and continuation. The likelihood of this risk is medium, as it depends on various factors, such as changes in the political and economic climate or unforeseen circumstances. However, ESRIUM has already secured funding from the Horizon2020 program, reducing the likelihood of this risk. To mitigate this risk, additional sources of funding could be sought, partnerships with other organizations could be explored, project costs could be optimized, critical



deliverables could be prioritized, and support could be sought from stakeholders such as the European Commission or industry associations.

The confidential version of this deliverable presents more information about risks and mitigation plans.

In conclusion, the ESRIUM project faces several risks that could impact its success. However, by developing strong partnerships, conducting extensive market research, and maintaining open lines of communication, the project team can mitigate these risks and ensure that the technology is widely adopted, providing significant benefits to road operators, truck fleet operators, and other stakeholders in the transportation industry.

7.3. Risk Matrix

A Risk Matrix, or probability and impact matrix, is a grid for mapping the probability of each risk occurrence and its impact on project objectives if that risk occurs. This matrix specifies combinations of probability and impact that allow individual project risks to be divided into priority groups. Risks can be prioritized for further analysis and planning of risk responses based on their probability and impacts. The probability of occurrence for each individual project risk is assessed as well as its impact on one or more project objectives if it does occur. Individual project risks are assigned to a priority level based on the combination of their assessed probability and impact, using a probability and impact matrix⁸.

In this case we used a 5x5 risk matrix, where colors mean (Table 18):

- Red: Critical risk. Requires urgent preventive actions. Urgent preventative measures are required. Service cannot be provided until these hazards are addressed immediately.
- Orange: Important risk. Preventive measures are required. During operation, the variables of the process/service must be strictly regulated.
- Yellow: Considerable risk. Analyze the economic feasibility of implementing preventative measures to decrease risk. If this is not possible, keep variables under control.
- Green: Marginal risk. It should be managed, but no immediate preventative measures are required.

The risk was rated on a scale of 1-5, where 1 means extremely low and 5 means extremely high. The total risk or Risk Value, for each potential risk, is determined by adding together the importance/impact rating and likelihood rating. Depending on the risk value result, the associated risk level is displayed in Table 17, in this can be defined as: Marginal, Significant, Serious and Very Serious.

Risk description	Likelihood (Occurrence)	Importance (Impact)	Risk Value	Level of Risk
Potential emergence of spinoffs and startups	3	4	12	Serious
Complexity of commercialization with different partners	4	4	16	Very serious
Low adoption or perception of being too sophisticated	3	3	9	Serious
Unforeseen difficulties	4	4	16	Very serious

⁸ Edition, PMBOK–Sixth. "A guide to the project management body of knowledge." Project Management Institute. Pennsylvania (2018).



Emergence of competing technologies or solutions	3	4	12	Serious
Lack of adoption or interest from potential customers	3	4	12	Serious
Not reaching an agreement	3	4	12	Serious
Fair IP compensation	4	4	16	Very serious
Lack of funding	3	4	12	Serious

Table 9: Risk Value and Level of Risk.

			IMPORTANCE (IMPACT)					
			VERY LOW 1	LOW 2	MEDIUM 3	HIGH 4	VERY HIGH 5	
LIKELIHOOD	VERY HIGH	5	5	10	15	20	25	
	HIGH	4	4	8	12	16	20	
	MEDIUM	3	3	6	9	12	15	
	LOW	2	2	4	6	8	12	
	VERY LOW	1	1	2	3	4	5	

Table 10: Risk Matrix.

From the observation of the matrix and the results obtained by positioning the potential risks encountered during the analysis, all risks have a relatively high level that must be taken seriously for the success of the project. In any case using a risk matrix can have advantages, such as present complicated data in a straightforward, understandable manner, but also disadvantages, such as categorizing the impact and likelihood of uncertain risks is frequently subjective and hence not completely trustworthy.

7.4. Risk Assessment and Priority Map

During the 4th consortium meeting, held in July 6th of 2023, partners detailed the risks and assed them with the priority map detailed in figure 6. After the meeting, this tool has been updated to ensure that most of the risks related to the project has been assessed and mapped.

The Key Exploitable Result (KER) Risk Assessment Map's Risk Assessment Tool is an organized method for locating, assessing, and reducing risks related to a project or endeavor. It offers a methodical approach to evaluating the likelihood and possible impact of different risks, and it assists in choosing the right solutions to control or lessen such risks. Let's dissect the main parts of this instrument:

- 1. Risk Description: The particular risks or difficulties that the enterprise might face are described in this section. Every danger has a thorough description that explains the possible problem.
- 2. Criticality: The importance or effect of a specific risk on the overall success of the project is measured by its criticality. Typically, ratings range from 1 to 10, with 1 denoting a low impact and



10 denoting a significant impact. Higher criticality ratings on the KER Risk Assessment Map indicate that the risk could seriously impede the project's success.

- 3. Probability: Probability evaluates the possibility that a risk will materialize. Additionally, it is ranked on a scale of 1 to 10, where 1 denotes a low chance of the danger materializing and 10 denotes a high possibility. A risk is more likely to occur if it has a high probability rating.
- 4. Risk grade: A computed value that offers a combined evaluation of criticality and likelihood is called the risk grade. It is calculated by multiplying the ratings for probability and criticality. A risk that is both extremely important and likely to happen is indicated by a higher risk grade. This aids in determining which dangers need to be addressed right away.
- 5. Potential intervention: The methods or steps that can be done to address and lessen the hazards that have been identified are described in this section. It is advised to take action to lessen the hazards' effects. They could consist of particular guidelines, rules, or practices that can be put into place to lessen the possibility or effects of a risk.
- 6. Estimated feasibility/success of intervention: The proposed interventions' viability and likelihood of success are evaluated in this rating. On a scale of 1 to 10, 1 denoting low feasibility or low expected success and 10 denoting high feasibility or high expected success, it is likewise graded. A high rating indicates a higher probability of the suggested intervention successfully reducing the risk.

An overview of the Key Exploitable Result (KER) Risk Assessment Map will be given in this part. This map lists the project's risks along with their criticality, probability, risk grade, possible interventions, and estimated feasibility. Partnership risk factors, technological risk factors, market risk factors, IPR/legal risk factors, financial/management risk factors, and environmental/regulation/safety risks are the risks detailed in this analysis.

Partnership risk factors: The intricacy of commercialization with several partners and the potential for failure to establish a consensus are two major risks mentioned in the Partnership category. These risks have high criticality and probability evaluations. The creation of thorough cooperation agreements, open lines of communication, progress evaluations, and backup plans are some of the recommended actions. These tactics seek to lessen the effects of these risks and guarantee productive partner cooperation.

Technological risk factors: A number of technological hazards are listed in the confidential version of this deliverable, such as low technology adoption, problems with Galileo HAS performance, restricted availability of road wear data, and others. Interestingly, the risk assessment takes into account both the likelihood and the criticality of these threats. The recommended mitigation plans center on market research, technological accessibility, and possible technology replacement in order to address these issues. Interventions might sometimes entail integrating current solutions to reduce hazards.

Market risk factors: Risks associated with the market include rival technologies or solutions, the formation of spinoffs and startups, and a decline in possible client interest or acceptance. These dangers are highly significant because of their high probability and criticality. To reduce these risks and promote market success, interventions suggest creating original value propositions, intellectual property tactics, and extensive market education initiatives.

IPR/legal risk factors: Legal and intellectual property threats are marked as having a high probability and criticality. Fair IP compensation is the main risk in this category. Clear criteria for IP compensation should be established, legal experts should be consulted, stakeholder negotiations should take place, and lines of communication should remain open. These steps are meant to guarantee that the intellectual property rights of the project are appropriately safeguarded and rewarded.

Financial/management risk factors: Financial and management risks are substantial, with the possibility of unexpected challenges, a lack of funding, and potential strategic decision deviations



noted as key concerns. The proposed interventions advocate the development of robust project plans, securing additional funding, and closely monitoring project activities to avoid inefficiencies.



Environmental/regulation/safety risks: There are no risks identified within this category.

According to a review of the risk classification offered, "Control" and "Action" risks are the main types of risks that the project works with. The analysis is broken out as follows:

Controlled Risks (13 risks): These risks are thought to be controllable with the right interventions and management mechanisms. Even though they could have a big influence if left unchecked, they are manageable with a few different tactics. The comparatively large number of "Control" risks indicates that the project team is actively seeking to put mitigation strategies into place after identifying possible obstacles. This proactive approach is critical to the project's success since it shows that you're prepared to address anticipated problems. The risks within this category are:

- Complexity of commercialization with different partners
- Not reaching an agreement
- Low adoption or perception of being too sophisticated.
- Galileo HAS not yet operational or not performing as expected during the project.
- Limited road wear data availability for training road wear detection algorithms
- Captured time-series of road wear data at too short time interval for the prediction.
- Long lead times for component orders delay hardware implementation.
- Galileo HAS not yet supported by commercial receivers during the project.
- C-ITS not available and/or not delivering RTCMEM messages.
- C-ITS technology is not available to test the interaction with the end users (roadside units, on-board units, C-ITS message content, C-ITS message provision)
- Data platform becomes subject to cyber-attacks.
- Lack of context information for road wear prediction
- Major strategic decisions cannot be resolved by, or within, the project.

Figure 6: Priority Map.



Action Risks (8 risks): Risks classified as "action" have a higher criticality and necessitate prompt notice and solution. These risks are more likely to materialize and could have a greater possible impact on the project. The project team is acting quickly to reduce these risks because they understand how urgently they need to be addressed. This shows how to manage serious risks to the project's success in a proactive and flexible manner. The risks under this category are:

- Potential emergence of spinoffs and startups
- Emergence of competing technologies or solutions
- Lack of adoption or interest from potential customers
- Fair IP Compensation
- Possibility of unexpected challenges throughout the development and commercialization processes
- Lack of Funding
- Wrong strategic decisions; Diverts developments from major to minor issues due to status misconceptions.
- Market Risk Factors

Summarizing Risks Table	
Number of "No Action" Risks	0
Number of "Control" Risks	13
Number of "Action" Risks	8
Number of "Warning" Risks	0
Number of Risks in the middle of everything	0
Number of Risks Between Control & No Action	0
Number of Risks Between Action & Warning	0
Number of Risks Between No Action & Warning	0
Number of Risks Between Control & Action	0

Table 11: Summary Risk Assessment.

To sum up, the utilization of the Risk Assessment Tool in conjunction with the Key Exploitable Result (KER) Risk Assessment Map offers a methodical approach to recognizing, assessing, and reducing project-related risks. The four primary divisions into which this analysis divides the identified hazards are "Control," "Action," "No Action," and "Warning."

Notably, the project's proactive approach to risk management is highlighted by the fact that most of the risks fall into the "Control" and "Action" categories. While the eight "Action" risks highlight the project team's alertness in swiftly resolving high-impact difficulties, the existence of 13 "Control" risks suggests a focus on putting policies in place to stop risks from getting worse.

The partnership's and the market's risk assessment lie between a high-risk grade and a high probability of success. Making sure that the benefits for partners are recognized and conveyed clearly is one suggested course of action to solve this.

Technology-related concerns are currently under control. To further mitigate potential difficulties, suggested corrective activities include verifying the product features and Unique Value Proposition (UVP) and Unique Selling Point (USP) with early adopters. Additionally, under control are market risks, which the consortium should consider as it refines the exploitation roadmap and plans the essential activities. Action and control scenarios include risk variables related to finances and



management. To keep focus and deploy resources effectively, it is advised to carefully identify the Minimum Viable Product. IPR/legal risk is currently under control, with fair compensation posing the biggest threat. The consortium should carefully evaluate the IP position in different exploitation scenarios, including third parties, consortium members, and joint ventures, given the existence of background and foreground intellectual property.

This balanced approach to risk management demonstrates a commitment to project success by effectively handling potential obstacles. By actively managing risks, the project can increase the likelihood of achieving its key exploitable results while minimizing the negative impact of potential challenges. The absence of risks categorized as "No Action" and "Warning" suggests that the project team is actively addressing all identified risks, acknowledging their significance and the need for intervention or control.

In the next steps of the project, continuous monitoring, timely execution of interventions, and the adaptability to changing circumstances will be crucial to maintain a strong risk management strategy and ensure the successful achievement of the project's objectives.

SECTION 8: JOINT EXPLOITATION SUPPORT AND RECOMMENDATIONS

As part of the exploitation strategy, we aim to improve the exploitation of results; hence, ESRIUM project applied to the European Commission program, Horizon Result Booster (HRB) to boost commercialization of project's results.

This initiative seeks to maximize the impact of publicly financed research in the EU while bringing a steady supply of innovations to market. It helps initiatives that are keen to go above and beyond their Dissemination and Exploitation (D&E) responsibilities, guiding research toward significant societal effect and emphasizing the importance of Research and Innovation (R&I) activity for societal concerns. To do this, HRB grants completed, or continuing research projects supported by the FP7, Horizon 2020, or Horizon Europe programs free consultancy services. Companies receive expert free of charge support services to boost the exploitation potential of their research results, disseminate effectively, and go to market. HRB offers 3 types of services:

- Portfolio dissemination and exploitation strategy (PDES): Identifying and compiling the findings of research and innovation projects, compiling the results, designing, and carrying out a portfolio dissemination strategy, and enhancing the current exploitation strategy. The two main streams of this service are Dissemination & Exploitation strategies, actions, and objectives. Dissemination services (Module A and B) are designed to increase the ability of Project Groups (PGs) to disseminate information, maximize the dissemination of a portfolio of results, and provide a broader and more comprehensive picture to potential consumers. The purpose of the Exploitation Service (Module C) is to assist individual projects in making use of their research findings and to increase the capacity of the beneficiaries to strengthen their exploitation strategy.
- Business plan development (BPD): By creating a strong business strategy and getting ready to find the right finance for project outcomes implementation, this service helps beneficiaries bring their results closer to the market. Beneficiaries of the project will receive guidance and support from the service as they are ready to market their project result(s). They will receive tailor-made training and support allowing them to develop a business plan which can include market analysis, business strategy, operations plan, competitive analysis, action plan and an estimation of time to market. Project beneficiaries will also receive assistance to identify solutions for implementation in terms of start-up operations, investors, and funding.
- **Go to market (G2M):** This service's goal is to help clients get their project outcomes ready for commercialization. The service will assist recipients in locating and/or removing potential



barriers to the commercialization of project outcomes and their utilization. assistance, coaching, and mentoring for activities related to getting a product to market, such as pitching, support and direction for intellectual property rights (IPR), training in innovation management, business services, examining options for business exploitation and implementation, and introduction to non-EU funding opportunities (i.e., investors).⁹

In ESRIUM, the three services of the HRB have been requested. From the following list, PDES (Module A and C) and BPD service has been received. The G2M service is taking place by the moment this deliverable is submitted (M36):

- PDES Module A: Identifying and creating the portfolio of R&I project results.
- PDES Module C: Assisting projects to improve their existing exploitation strategy,
- BPD: Support on developing a business plan
- G2M Pitching,
- G2M Examining exploitation/business implementation options.

The feedback of HRB's experts helped us to improve the joint exploitation roadmap. Different meetings were held in collaboration with the expert and the project partners to ensure a good identification of the actions and next steps to commercialize ESRIUM, which are detailed in Section 6.2. Moreover, participating in this service help us to identify assess and prioritize risks, with the use of the risk assessment tool, which is the basis of Section 7.3. The expert, partners and innovation manager carefully went through risks and mitigation plans. In addition, HRB assisted to properly define the target customer by using the persona definition methodology, explained before in this dcoument. The expert recommendations are listed as follows:

Issues	Recommendations
Characterization of KERs	One KER was considered at the online ESS. The discussion was very participative, withall the partners contributing. The seminar helped to focus on the main aspects to be considered in the future elaboration of D6.7 – Final PEDR due at the end of the project's life.
	The characterization of the KER in this instance was retrofitted to the template/tool from the full business plan that had already been delivered by the project. The main challenge of the project is to identify a suitable exploitation vehicle, and the ESS has been focused discussing this challenge. As such some of the comments made are already addressed in the full document. The recommendation here is to utilize the templates and tools to help with a succinct presentation of the business case and business plan, which would help not only the project team's approach the exploiting3 rd party, but it would also help as living document as the solution matures and as further parties involved impact the use model and potential revenues.
Exploitation Roadmap	The immediate exploitation strategy is the application to a follow-on grant to increase the TRL of the system solution and to engage additional parties that could take ownership of further exploitation and ultimately commercialisation. The ESS workshop helped in identifying actions in the next few months to help further this strategy, including an innovative approach in characterising the 3 rd party that could be involved in the exploitation of the KER.

⁹ https://www.horizonresultsbooster.eu/



Discussing Exploitation at Consortium Meetings	 The project has already planned to continue the exploitation discussions at consortium meeting and to utilise sessions to further examine the exploitation vehicleopportunities. This is commendable and it can only be encouraged to continue. The project should consider the Exploitation Plan as a living document to help guide nextsteps and to update as the situation evolves and matures and: Consider reviewing the UVP and the use model in the follow-on grant and with thepotential 3rd parties with exploitation intentions;
	 Review accordingly Early Adopters market and revenue projections with the exploiting party.
Monitoring Risk Analysis	The risks and mitigating actions identified provide also a guide for the action plan and exploitation roadmap. It is recommended to review the risks and mitigation actions as part of the project meetings to follow the situation as it evolves and to inform nextsteps.

Table 12: HRB's expert recommendations.

The expert's primary recommendations are centered on enhancing the presentation and exploitation of the ESRIUM project's Key Exploitable Results (KERs). These suggestions include:

- **Refined Characterization of KERs:** Utilizing specific templates and methodologies to succinctly define and present the Key Exploitable Results. This step is vital for clearly communicating the value and potential of these results to stakeholders and potential partners.
- **Dynamic and Adaptable Exploitation Plan:** Emphasizing the importance of maintaining a flexible exploitation plan that can evolve in tandem with the project's progress. This approach allows for adjustments and refinements in response to new developments and insights, ensuring the plan remains relevant and effective.
- **Collaboration Models with External Parties:** Encouraging the use of collaborative models that involve potential external parties. This strategy aims to broaden the scope of exploitation by leveraging external expertise, resources, and market access.
- Enhancing the Unique Value Proposition (UVP): Focusing on improving the Unique Value Proposition of the project's outcomes. This involves clearly articulating the unique benefits and competitive advantages of the ESRIUM project's results, making them more appealing to the market and stakeholders.
- **Continued Engagement and Risk Management**: Stresses the importance of continuous dialogue during consortium meetings and routine reviews of risk analysis and mitigation strategies. This continuous engagement is crucial for addressing challenges promptly and ensuring all partners are aligned and committed to the project's objectives.

All the suggestions provided by the expert were taken into serious consideration and have been implemented throughout the lifetime of the ESRIUM project. Each recommendation was methodically integrated into the project's strategy and execution. This included refining the characterization of Key Exploitable Results (KERs), adopting a dynamic and adaptable exploitation plan, enhancing collaboration models with external parties, and improving the Unique Value Proposition (UVP).

The project team ensured that these expert insights were not only acknowledged but actively incorporated into the ongoing project activities. Regular consortium meetings provided a platform for discussing these recommendations, aligning strategies, and updating risk management approaches based on the evolving project landscape. This proactive approach to incorporating expert



advice has significantly contributed to the project's effectiveness and its ability to achieve its objectives efficiently.

By implementing these expert suggestions, the ESRIUM project demonstrated its commitment to flexibility, innovation, and continuous improvement, thereby enhancing its potential for success and impact in its respective field.

In our pursuit of effectively commercializing the ESRIUM project and ensuring that its results are fully leveraged by the industry, we have undertaken several critical tasks. One of our initial steps was to create an ESRIUM profile on the Invest EU Portal. This platform serves as a valuable tool for innovators, offering them the opportunity to showcase their projects and establish connections with key stakeholders in the industry.

Additionally, the project has been submitted for the EU Deal Flow matchmaking services. This venture building initiative is designed to support promising EU-funded startups, helping them gain visibility and access to essential resources. Applying for this service represents a strategic move to elevate the profile of our project, opening doors to potential investors, collaborators, and partners.

In our journey towards commercializing the ESRIUM project, we have engaged in valuable discussions with leading companies in the mobility and Intelligent Transport Systems (ITS) sector. Notably, we had the chance to explore potential commercialization pathways wit companies at the forefront of developing innovative mobility solutions for highway authorities, cities, and mobility providers worldwide.

Partners such as EVOLIT and JRD represented the ESRIUM project in these dialogues. During these sessions, it was noted that while the project shows significant potential, the current Technology Readiness Level (TRL) is relatively modest. This suggests that further development and enhancements are necessary before considering substantial investments. These conversations have been instrumental in obtaining initial feedback and gauging market interest, marking an essential first step in our commercialization efforts.

Building on our initial engagements with key players in the market, we have also initiated exploratory discussions with prominent players in the mapping and navigation sector. These discussions have been invaluable, providing us with opportunities to introduce the ESRIUM project and explore potential collaborative ventures. Such interactions are pivotal for gaining a deeper understanding of the industry dynamics, aligning our project objectives with current market demands, and identifying potential partnership opportunities.

Additionally, within our own consortium, particularly the JRD team, we have conducted in-depth internal deliberations on the best approaches to commercialize the ESRIUM project. One key decision that emerged from these discussions was the recognition of the need for a dedicated entity to spearhead the promotion of ESRIUM. In pursuit of this, the consortium is planning to have dialogues with the road assessment programs and companies in that sector.

Our vision is to integrate ESRIUM as a complementary addition to current offerings of road assessment companies, thereby enhancing their service portfolio with our project's innovative capabilities. Such a partnership holds the promise of unlocking substantial opportunities for both parties, with the potential to drive significant advancements in road safety and infrastructure management.

In our continuous effort to exploit the results of the ESRIUM project effectively, we have also utilized another key resource offered by the European Commission: the Horizon Results Platform. This platform serves as a vital tool for innovators, providing a space to showcase their project outcomes, network with potential partners, and pitch their results to investors. Various partners from the ESRIUM project, including JRD, FGI, VIF, NNG, and EVOLIT, have actively utilized this platform, uploading details about their exploitable results. The specific results shared on the platform



encompass a range of innovations and developments that have stemmed from our collaborative efforts. These uploads not only increase the visibility of our individual contributions but also enhance the overall profile of the ESRIUM project, opening doors to potential collaborations and funding opportunities. By leveraging platforms like the Horizon Results Platform, we are ensuring that the groundbreaking results of our project reach a wider audience and attract the interest and support they deserve.

Result	Partner
Towards Requirements related to Future CCAM Services for Road Usage Optimization	FHO
Authenticated Automated Trajectory Following using Galileo OSNMA	VIF
Infrastructure-assisted adaptive ADAS/AD System	VIF
Low Cost Road Wear Sensor Platform	JRD
Road Wear Map	JRD
Al-based road damage prediction to support enhanced road maintenance planning	Evolit
Map as a service	NNG
Galileo OSNMA: implementation, usage and related know-how for secure positioning and navigation	FGI

Table 13: Results Uploaded To HRP.

As a result of our exploitation efforts, the consortium decided to apply to a follow up project (as it has been mentioned previously) to continue developing our technologies, so that the exploitation of results can be effective and succesful.

SECTION 9: CONCLUSIONS

The ESRIUM D6.7 Final Exploitation Plan stands as a pivotal document in the ESRIUM project's journey, exemplifying a strategic and multifaceted approach towards realizing its full potential and making a meaningful impact in the road management sector. This document, building upon the initial exploitation strategies outlined in D6.6, presents an updated, comprehensive framework for the exploitation of the project's research outcomes, reflecting the collaborative achievements of the consortium and adapting to the evolving market and regulatory scenarios.

Extensive Achievements and Strategic Developments

Robust Intellectual Property and Exploitable Results Framework: The plan's thorough approach in identifying and categorizing 14 background IPs and 8 foreground IPs, along with 10 exploitable results and 8 knowledge results, demonstrates a comprehensive understanding of the project's technological scope. This categorization crucially aligns with targeted market segments and user demands, facilitating tailored technological solutions.

In-Depth Target Market Analysis and Impact Assessment: The plan extensively analyzes target customers, including road operators, OEMs, ADAS system developers, and vehicle end-users, highlighting the ESRIUM solution's positive implications for environmental sustainability and road



safety. This includes a detailed assessment of how the project can contribute to reducing maintenance efforts and costs.

Dynamic Individual and Joint Exploitation Strategies: Partners within the consortium have outlined distinct strategies for commercial exploitation of assets and knowledge, reflecting the diversity and strength within the group. Furthermore, the exploration of joint strategies has culminated in the decision to undertake the ESRIUM LS follow-up project, underscoring a commitment to technological progression and market expansion.

Comprehensive Market Strategy and Exploitation Roadmap: The document delineates a methodical strategy to elevate the ESRIUM project's TRL and broaden its market scope. Central to this are efforts in updating the business plan, exploring consumer preferences, intellectual property protection, seeking public funding, and assessing policy impacts.

Integration with European and Global Standards: A key aspect of the ESRIUM project is its alignment with European and global standards for road safety and infrastructure management. The project's results and methodologies have been developed with a keen understanding of these standards, ensuring that the solutions are not only innovative but also compliant and relevant on a broader scale. This alignment is critical for the project's acceptance and success in various markets, making it a viable solution for a diverse range of stakeholders within the road management ecosystem.

Enhancing the Technological Ecosystem: The ESRIUM project contributes significantly to the technological ecosystem by providing cutting-edge solutions for road wear assessment and infrastructure management. The technologies and methodologies developed in the project are expected to catalyze advancements in the sector, paving the way for more efficient, accurate, and sustainable road management practices. By pushing the boundaries of what is currently possible, ESRIUM sets new benchmarks in the industry.

Sustainability and Environmental Impact: The plan emphasizes the project's contribution to sustainability and its positive environmental impact. By enabling more efficient road maintenance and promoting safer road conditions, ESRIUM contributes to reduced carbon emissions and resource conservation. This aspect of the project aligns with broader global goals of sustainability and environmental protection, enhancing its appeal and relevance in today's eco-conscious market.

Long-Term Vision and Scalability: The ESRIUM project is not only focused on immediate market entry and exploitation but also on long-term vision and scalability. The plan outlines the project's potential for growth and adaptation in the rapidly evolving technological landscape. This foresight ensures that the project remains relevant and continues to provide value in the face of changing market demands and technological advancements.

Stakeholder Engagement and Community Building: The project acknowledges the importance of stakeholder engagement and community building. By actively involving key stakeholders in the development and exploitation process, ESRIUM ensures that the solutions are tailored to meet real-world needs and challenges. This approach fosters a sense of community and collaboration, which is essential for the widespread adoption and success of the project's outcomes.

Knowledge Transfer and Capacity Building: The plan also highlights the project's role in knowledge transfer and capacity building. By sharing insights, methodologies, and best practices developed during the project, ESRIUM contributes to the broader knowledge base in the field. This transfer of knowledge not only enhances the capabilities of current stakeholders but also empowers future innovators and practitioners in the sector.



Forward-Looking Actions and Market Integration Outlook

Proactive Market Exploitation and Rigorous Risk Management: The plan stresses the importance of continuous market exploitation and efficient risk management. It meticulously addresses potential challenges and formulates modular and adaptable solutions, in line with European ITS regulations.

Persona-Centric Commercialization Focus: A detailed analysis of personas within target companies provides invaluable insights into their unique preferences and pain points. This knowledge enables ESRIUM to tailor its strategies effectively, enhancing its appeal in the competitive innovation, technology, and mapping sectors.

HRB Services as a Catalyst for Strategy Enhancement: The instrumental role of HRB services in refining the project's exploitation strategies and developing a robust business plan is highlighted. These services have provided essential support in enhancing the project's commercial potential.

Strategic Industry Engagement and Collaboration: The project's initiatives to create a presence on the Invest EU Portal, utilize EU Deal Flow matchmaking services, and engage with industry giants demonstrate a proactive approach towards commercialization. Additionally, discussions with organizations in the road assessment sector have provided clarity on potential commercialization avenues, signifying the project's commitment to maximizing its commercial viability while contributing to road infrastructure improvements and safety.

Next steps

Essentially, the detailed business plan for ESRIUM highlights important discoveries that shed light on the complexities and needs of the road infrastructure management sector. The market has a lot of potential, as evidenced by the increasing need for effective road maintenance systems, but there are obstacles to overcome, such as different stakeholder preferences and the maturity levels required by important industrial partners. Our plan to launch the comprehensive ESRIUM solution into the market revealed the industry's propensity for comprehensive, trunky solutions that are favored by road operators, but concessionaires frequently give priority to small, state-mandated maintenance expenditures over long-term predictive solutions. The market is still quite large despite these complications, indicating that there are many prospects for ESRIUM's complete road wear management system. This business plan gives ESRIUM the best possible position to traverse these obstacles by providing a customizable end-to-end solution that caters to the changing needs of the road infrastructure management industry through a thorough research of market dynamics, stakeholder preferences, and industry trends. Undoubtedly, ESRIUM's route to commercialization entails a thorough plan that incorporates several tactical measures to guarantee a smooth transition from project completion to broad deployment. Using the knowledge and expertise obtained from the ESRIUM project, the business plan's refining is a crucial stage. This entails reevaluating the dynamics of the market, improving revenue models, and potentially hiring outside advisors to strengthen the strategy for future market preparation. The business model for ESRIUM has already been updated; nevertheless, it should be revisited and refined as new strategies arise.

Simultaneously, protecting the intellectual property created during ESRIUM continues to be a top concern. This entails persistent research on safeguards, possible licensing contracts, and obtaining legal counsel to guarantee the security of cutting-edge technology.

Seeking public grants or private investments will be a major next step. Currently, the consortium is looking for new grants to help diversify financing sources and support ongoing research and development efforts that are required to advance ESRIUM's technology to higher TRLs. A supportive regulatory environment necessitates both investigating the possible effects of policy changes and interacting with pertinent stakeholders at the same time.



Working with other parties, such as possible competitors and possible partners, necessitates a diversified strategy. This entails comprehending the tactics used by other companies that develop similar solutions as ESRIUM, seeing prospective areas of cooperation, and developing extensive plans that take into account both independent and cooperative market opportunities.

It is crucial that ESRIUM's technology is continuously enhanced in order to reach a higher TRL and guarantee that it is ready for broad adoption. Collecting and documenting the most significant takeaways from expanded pilots might yield valuable information for future development and use. The emphasis of ESRIUM's upcoming chapter will continue to be on strategic partnerships, ongoing innovation, and flexibility in response to changing market conditions. In order to achieve its ultimate goal of revolutionizing road infrastructure and transportation systems and securing its place as a leader in the Intelligent Transport Systems space, ESRIUM is devoted to refining technologies, growing collaborative ventures, and maintaining a strong presence within industry networks.

In conclusion, the ESRIUM D6.7 Final Exploitation Plan is not just a strategic document for the project's commercialization but also a testament to its potential in contributing significantly to the road infrastructure and safety sectors. By addressing potential barriers, leveraging the consortium's collective strengths, and engaging with key industry players, the plan sets a clear and actionable path for ESRIUM to successfully commercialize its results, offering extensive benefits to a broad spectrum of customers and stakeholders in the dynamic world of road management and safety.



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ANNEX I: JOINT EXPLOITATION STRATEGIES CONSIDERED DEFINITIONS

Assignment - Through an assignment the ownership of IP is permanently transferred from one party (the assigner) to another party (the assignee). Consequently, the assignee becomes the new owner of the IPR. The advantages of a permanent assignment are the availability of immediate cash flow return to be invested in further R&D activity, as payments usually take the form of a lump sum payment. Besides, the assignor would have no further responsibility for the management of the IP title, including the payment of fees or the monitoring of infringements. On the other hand, an assignment causes the loss of control over the IPR. Therefore, any use by the assignor would amount to an infringement once the assignment is in force, except if certain uses are provided for in the agreement (such as for further research). An assignment could also be non-beneficial in terms of socio-economic benefits if the assignee does not have the skilled employees or the established business network to valorise it.

Licence - A licence agreement is a contract under which the holder of IP (licensor) grants permission for the use of the intangible asset concerned to another person (licensee), within the limits set by the provisions of the contract. When it comes to negotiate licence agreements, it is important to understand why PROs wish to license their IP, and which licence is more suitable to the specific case, as well as the potential risks of entering in such deal. Partners should set a licensing policy, in order to harmonise practices and ensure fairness in all deals. In particular, transfers of ownership of IP owned by Partners and the granting of exclusive licences should be carefully assessed, since this can diminish or eliminate the control over the IP asset. Licences for exploitation purposes should involve adequate financial compensation, as well as other types of benefits. Licences can provide research results with faster access to markets, Partners with additional source of income and control over their IP, all at once. On the contrary, PROs can lose control of information flowing from further development of the technology by virtue of the licence. The latter can affect the income streaming if lacking the skills and business network needed, which is particularly dangerous in exclusive licences.

Joint venture - is a type of collaborative commercialisation. It is a situation where scientists and private companies jointly commit resources and research efforts to projects; research activities are carried out jointly and may be co-funded. Joint venture may range from short-term projects (non-incorporated joint venture), normally narrow in scope, to long-lasting strategic partnerships with multiple members and stakeholders (joint venture company). More specifically, the parties to the joint venture share risks and contribute with their intellectual capital to technology research and development, production, marketing, and further commercialisation. The most significant advantage can be considered as the ability of PROs to reap economic benefits from the commercialisation of their already existing IP, or the one resulting from the joint venture. Other associated advantages can be summarised as follow:

- Access to technology at affordable prices
- Access to resources do not present on the market
- Sharing of R&D, marketing, and commercialisation costs
- Utilisation of unused or not-usable IP assets
- Reduced investment risks
- Development of new products
- Access to new markets

Since a few IPRs are involved in a joint venture, Partners need to carefully define through licences the access to their and other parties' pre-existing IP, i.e., background, as well as the access to the generated IP, i.e., project results, that will be owned by the author-party and used by other parties in the venture.



Spin-off - A spin-off refers to a separate company usually established to bring IP, in this case resulting from public funding, onto the market. It is deemed to be a valuable channel to transform the Partners' technology into product and service, as well as to license out technology. Creating spin-off companies would allow ESRIUM Partners to:

- Outsource the development process that might not fit with the PRO's scientific objectives.
- Obtain funding not available for purely research institutions to partially cover development costs.
- Participate in a European-funded research programme as an industrial partner.
- Endow research staff with entrepreneurial skills.

The creation of a spin-off is a complex process entailing the development of a separate business with the subsequent allocation of IPR and responsibilities, project, and risk management and, in certain circumstances, fund raising to attract investors for financial contribution. In the initial stages when a spin-off is founded, a strategic decision should be taken on how the new company will acquire the IP belonging to Partner/s. Two main methods exist: the contribution in kind from the PRO or the licensing of its intangible assets. Partners should develop and publicise a spin-off policy, allowing and encouraging their staff to engage in the creation of spin-offs, where appropriate, and clarifying long-term relations between spin-offs and Partners.

Consultancy agreements - Such agreements are established between organisations willing to provide advice to companies on specific matters, in return for payment of a fee. Companies engage in these partnerships for different objectives, such as to get assistance to overcome a technical problem, or to analyse a concrete technical matter or data.



ANNEX II: PERSONA PROFILE DEFINITION BY TARGET CUSTOMER





Persona 2 (OEMs)

Who is s/he? Age: Position: Experience: Managing director Other information: 	 How s/he finds us? Referral by someone trusted? Use the information we provide through the website? Cold outreach through email or social media? 	 Pain Points E.g., lack of personal and budget for mapping all the areas
Character: • Conservative • Risk-lover		
 Innovator Other information: How to reach him/her? Email/face to face LinkedIn/twitter Events/conferences ✓ Business? ✓ academic2 	What s/he wants to know? Latest projects Expertise Partnership and Joint Venture Testimonials Awards Impact/results	 What s/he doesn't want E.g., High prices, Dealing with multiple entities, mapping themselves, using their devices for mapping, etc.
 V academic? Other Type/form of communication: Formal? Informal? 	 Why s/he buys from us? Price Quality (precision, speed, etc.) To comply with regulation To be competitive (differentiate their service from others) Expertise Others (What?) 	Other considerations to take into account • Negative Trends • Positive trends • Hopes • Opportunities • Headaches

Persona 3 (Tech)

Who is s/he? Age: Position: Experience: CTO Other information: 	 How s/he finds us? Referral by someone trusted? Use the information we provide through the website? Cold outreach through email or social media? 	 Pain Points E.g., lack of personal and budget for mapping all the areas
Character: • Conservative • Risk-lover		
 Innovator Other information: 	What s/he wants to know? • Latest projects • Expertise	 What s/he doesn't want E.g., High prices, Dealing with multiple entities, mapping themselves, using their
How to reach him/her? • Email/face to face • LinkedIn/twitter • Events/conferences ✓ Business? ✓ academic?	 Partnership and Joint Venture Testimonials Awards Impact/results 	devices for mapping, etc.
Other Type/form of communication: • Formal? • Informal?	 Why s/he buys from us? Price Quality (precision, speed, etc.) To comply with regulation To be competitive (differentiate their service from others) Expertise Others (What?) 	Other considerations to take into account Negative Trends Positive trends Hopes Opportunities Headaches



Persona 4 (Commercial 3rd partv)

Who is s/he?

- Age:Position:
- · Experience:
- · Other information:

Character:

- Conservative
- Risk-lover
- Innovator
- · Other information:

How to reach him/her?

- · Email/face to face
- LinkedIn/twitter · Events/conferences
- ✓ Business?
- ✓ academic?
- Other

- Type/form of communication:
- Formal? Informal?

 How s/he finds us? Referral by someone trusted? Use the information we provide through the website? Cold outreach through email or social media? 	 Pain Points E.g., lack of personal and budget for mapping all the areas
What s/he wants to know? • Latest projects • Expertise • Partnership and Joint Venture • Testimonials • Awards • Impact/results	 What s/he doesn't want E.g., High prices, Dealing with multiple entities, mapping themselves, using their devices for mapping, etc.
 Why s/he buys from us? Price Quality (precision, speed, etc.) To comply with regulation To be competitive (differentiate their service from others) Expertise Others (What?) 	Other considerations to take into account • Negative Trends • Positive trends • Hopes • Opportunities • Headaches

Persona 5 (Road Operator & International Association member)

Who is s/he? • Age: 35 • Gender: Female • Position: Team leader • Experience: Traffic Management, National and international R&D projects, association work – group lead • Other Information: technical background, member of steering	 How s/he finds us? Referral by someone trusted European conferences and association meetings Website social media 	 Pain Points lack of existing C-ITS use cases for deployment Lack of evidence-based impact for innovative services
boards Character: • Innovator • Techology expert in the domain of ITS, CCAM	 What s/he wants to know? Innovation aspect and integrability into the own company Project partner Impact/results 	 What s/he doesn't want Low TRL level High investment cost without given positive impact potential
 How to reach him/her? LinkedIn/twitter Events/conferences and face to face there Type/form of communication: Informal as a starting point Formal when it comes to starting business 	 Why s/he buys from us? Quality (precision, speed, etc.) To strengthen the C-ITS topic (deployment) Expertise – potential impact of solution 	Other considerations to take into account • What do other road operators think? • How do they proceed with the topic?



Persona 5 (Road Operator)

Who is s/he? • Age: 50 • Gender: Male • Position: Team leader • Experience: Asset Management, National and International R&D projects. • Other Information: technical background	 How s/he finds us? Referral by someone trusted European conferences and association meetings Website 	 Pain Points Huge effort for asset management procedures (sensing, data provision, <u>visualisation</u>) Limited resources for increasing the quality of the existing procedures
Character: Conservative Techology expert in the domain of Asset management How to reach him/her? Email/face to face Linkedin/twitter Events/conferences	 What s/he wants to know? Innovation aspect and integrability into the own company Technical details on the sensing issues, the AI and the prediction quality Project partner Impact/results on asset management (cost savings, precision, needed resources for operational management) 	 What s/he doesn't want Low TRL level High investment cost without given positive impact potential Products which cannot be integrated into the internal procedures
 Type/form of communication: Formal 	 Why s/he buys from us? Quality (precision, speed, etc.) Expertise – potential impact of solution on asset management topics 	Other considerations to take into account What do other road operators think? How do they proceed with the topic?