



FLASH-COMP

D8.3– Business, exploitation and continued use planning and market analysis

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Executive summary

This deliverable presents the exploitation and business-planning strategy for the results generated by FLASH-COMP. It connects the project's technical achievements with the commercial, developmental, collaborative and continued-use pathways through which those achievements may create value beyond the funded project. Its purpose is not to assume that every result will become a commercial product, but to establish what has been produced, what value it offers, who is responsible for it, what further work may be required and what realistic opportunities exist for its future exploitation or reuse.

The consortium has classified the results portfolio into five Key Exploitable Results, five Exploitable Results and three Usable Results. This classification reflects the maturity, commercial potential and intended future use of each result:

- **Key Exploitable Results** have the clearest potential for commercial or market-oriented exploitation and are supported by business-planning considerations.
- **Exploitable Results** have potential for further development, integration, industrial application or research exploitation and are supported by development action plans.
- **Usable Results** are not principally intended for sale as standalone products but can continue to create value through training, research, standardisation, dissemination, knowledge transfer, partner positioning and future collaboration.

For each result the market analysis identifies a favourable long-term context for technologies that improve manufacturing quality, process visibility, resource efficiency and data-supported decision-making. However, technical achievement and market relevance do not in themselves establish commercial readiness. Adoption will also depend on the reliability and repeatability of the solutions, ease of integration, evidence of industrial benefit, ownership and access rights, implementation costs, user skills, partner capacity and the availability of further finance or investment.

Accordingly, this deliverable presents the result-level plans as realistic decision frameworks rather than firm commitments to undertake unfunded post-project development. At the time the project ends, the responsible partners must determine which results align sufficiently with their strategies and market opportunities to justify further technical, commercial or financial commitment. Some may be progressed through partners' existing products, services and research activities; others may require new collaboration agreements, industrial partners, customer-funded implementation or follow-on public funding. Results that are not immediately commercialised can remain valuable through continued application, demonstration, research, training and reuse.

Conclusion

The principal outcome of this planning process is a structured exploitation portfolio that makes the available opportunities, responsibilities, dependencies and remaining decisions visible. It provides partners with a basis for evaluating follow-up activity and enables reviewers and stakeholders to understand how FLASH-COMP's outputs could progress towards commercial adoption, further development, collaboration and continued use.

In doing so, the deliverable supports an outcome-focused approach to communication, dissemination and exploitation: one concerned not only with promoting what the project has achieved, but with placing its results in the strongest practicable position to generate value beyond the project's funded lifetime.



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List of abbreviations

Abbreviation	Explanation
DSET	Defect Severity Estimation Tool
DSS	Decision Support System
ERs	Exploitable Results
FOS	Fiber Optic Sensors
HMI	Human Machine Interface
HSI	Hyperspectral Imaging
KERs	Key Exploitable Results
LIMS-based	Liquid Injection Moulding Simulation based
LRI	Liquid Resin Infusion
MOR-based	Model Order Reduction based
MQTT	Message Queuing Telemetry Transport
TRL	Technology Readiness Level
URs	Usable Results
ZDM	Zero Defect Manufacturing



1. INTRODUCTION

1.1. Document purpose

This document presents the exploitation and business-planning strategy for the results generated by the FLASH-COMP project. Its purpose is to explain how the technologies, methodologies, knowledge and capabilities developed through the project can continue to create value after the funded activity ends.

The document brings together the project's technical achievements, agreed exploitable-result portfolio, initial market research and information provided by the partners responsible for taking individual results forward. It provides a structured basis for deciding what form of exploitation is appropriate for each result, what further development may be required and what actions should be taken after the project.

FLASH-COMP has generated results with different levels of maturity and different forms of potential value. Some have clear commercial potential and require detailed business planning. Others require further technical development, industrial validation or collaborative research before a commercial route can be established. A further group of results will create value through continued use in training, research, marketing, scientific positioning, standardisation and future project development.

The document therefore does not treat exploitation solely as the direct sale of products. It addresses commercialisation alongside licensing, integration, consultancy, research collaboration, training, knowledge transfer, demonstration, marketing and the strengthening of partners' existing capabilities and services.

1.2. Project context

FLASH-COMP was established to develop a fast, reliable and human-oriented quality-control solution for liquid resin infusion composite manufacturing. The project has investigated how inspection and monitoring technologies, data management, simulation, artificial intelligence and operator-oriented decision support can be combined to identify process conditions and potential defects in time to support appropriate corrective action.

The project's technical work has included the development and adaptation of inspection and monitoring tools, systemic data management, simulation and data-processing capabilities, physical and digital testbeds, industrial validation and sustainability assessment. These activities have been supported by work addressing operators' skills, training requirements, communication, dissemination, stakeholder engagement, standardisation and exploitation.

The resulting portfolio includes both individual technologies and integrated solutions. Sensor and imaging technologies collect information from manufacturing processes. Data-processing and simulation tools interpret that information. The digital platform supports the management and presentation of process data, while the Decision Support System brings together relevant information to support operator understanding and decision-making.

The project has also generated results beyond the integrated technical system. These include testbed and demonstrator capabilities, a manufacturing sustainability assessment methodology, training resources, standardisation analysis and scientific publications. Although these results require different exploitation approaches, each can contribute to the longer-term impact of FLASH-COMP.



1.3. Need for exploitation planning

The completion of technical development does not in itself ensure that a project result will be adopted, commercialised or used after the project. Further action may be required to increase maturity, validate performance, identify customers and users, determine ownership and access rights, establish partnerships, secure funding or integrate the result into an existing product or service.

Exploitation planning provides the connection between project delivery and continued use. It establishes:

- What each result is and what value it offers;
- Its present maturity and validation status;
- Who is responsible for taking it forward;
- Who may use, purchase or benefit from it;
- Whether it will be exploited independently or as part of a combined solution;
- What technical, commercial or collaborative barriers remain;
- What actions and resources are required after the project;
- How progress and impact can be assessed.

This planning is particularly important for FLASH-COMP because several results are interdependent. Some components may be exploited independently, while others may produce a stronger proposition when combined. MSI's generic Data Platform provides the digital foundation for a wider Decision Support System but does not include sector- or process-specific data, data models or algorithms. The Combined DSS is created by adding process-specific data and models, INEGI's simulation capability, LORTEK's analytical and AI contributions, and the DSS, HMI and decision-support functionality required for the manufacturing application. Inspection and monitoring technologies may also be exploited independently or within a broader hardware-software solution.

The exploitation strategy must therefore address the portfolio at two levels: the future pathway for each individual result and the opportunities created through integration and collaboration.

1.4. Scope of the document

The document covers the complete portfolio of results classified by the consortium as **Key Exploitable Results**, **Exploitable Results** and **Usable Results**.

Key Exploitable Results (KERs) are subject to detailed business planning because they have the clearest commercial potential and are considered suitable for immediate or near-term market preparation. **Exploitable Results (ERs)** are supported by development action plans that identify how they can advance towards commercial use, integration or further collaborative research. **Usable Results (URs)** are supported by competitiveness and continued-use strategies that explain how they will strengthen partners' knowledge, capabilities, services, visibility and future collaboration.

The document also examines the wider market and stakeholder environment in which exploitation will take place. This includes the development of zero-defect manufacturing, the adoption of enabling technologies, relevant industrial sectors, market drivers and barriers, potential competitors and collaborators, policy considerations and possible funding or investment routes.

Detailed ownership, intellectual-property, access-rights and commercial information will be based on the completed questionnaires supplied by the partners responsible for the relevant results. Where



information is not yet confirmed, the document will distinguish between demonstrated project achievements, proposed exploitation routes and actions still requiring partner agreement.

1.5. Evidence base

The exploitation strategy draws on four principal sources of information:

- The FLASH-COMP technical reports and other project documentation, which provide evidence of development, integration, validation and Technology Readiness Level;
- The consortium's agreed classification and description of the KERs, ERs and URs;
- Market research, stakeholder analysis and engagement activity carried out in WP8;
- Completed exploitation questionnaires and supporting information provided by the responsible partners.

Technical claims concerning FLASH-COMP's results will be based on project documentation. Partner questionnaires will provide the principal evidence for ownership, access rights, commercial intentions, resource requirements, dependencies and post-project commitments. Market information will be used to assess the environment surrounding the results and will be distinguished from evidence of technical achievement.

This approach is intended to ensure that the exploitation plans remain realistic, evidence-based and aligned with the capabilities and intentions of the organisations responsible for implementation.

1.6. Document structure

Following this introduction, **Chapter 2** explains the FLASH-COMP exploitation approach, including the definitions of **KERs**, **ERs** and **URs** and the tailored planning process applied to each category.

The subsequent chapters and sections will:

- Describe FLASH-COMP's technical concept, achievements and resulting portfolio;
- Present the agreed KERs, ERs and URs and their relationships;
- Examine the ZDM market, relevant industrial sectors and stakeholder landscape;
- Assess integrated exploitation opportunities;
- Present the individual business plans for the KERs;
- Set out development action plans for the ERs;
- Define competitiveness and continued-use strategies for the URs;
- Identify common risks, dependencies, funding needs and opportunities;
- Consolidate the planned actions within a post-project exploitation roadmap.

The following executive summary reflects the final evidence, conclusions, priorities and agreed actions contained in these sections of this document.

2. EXPLOITATION APPROACH

2.1. Purpose and scope

The FLASH-COMP exploitation approach provides a structured framework for ensuring that the knowledge, technologies, methodologies and capabilities generated by the project continue to create value after the funded activity ends. Commercialisation is an important part of this process, but exploitation is not limited to bringing products directly to market. Results can also be exploited through licensing, integration into existing products and services, further research and development,



collaborative projects, training, demonstration, consultancy, knowledge transfer, standardisation activities and the strengthening of partners' technical and market positions.

FLASH-COMP has therefore classified its results according to their maturity, commercial potential, development needs and likely future use. Three categories have been established: **Key Exploitable Results (KERs)**, **Exploitable Results (ERs)** and **Usable Results (URs)**. Each category is subject to a different level and form of planning, ensuring that the work required is proportionate to the nature of the result and the value it can deliver.

This classification does not imply that one category is valuable while another is not. Instead, it recognises that project results create different forms of value and require different pathways to realise that value. A result with a clear route towards commercialisation requires a different plan from a research asset requiring further validation, or from a demonstrator, publication or training resource that strengthens an organisation's capabilities and reputation.

2.2. Meaning of exploitation in FLASH-COMP

For FLASH-COMP, exploitation is the process through which project results are used to generate benefits after their development. These benefits may be economic, technical, scientific, educational, environmental or strategic.

Commercial exploitation may include the direct sale of a product or service, licensing, technology transfer, consultancy, integration into an existing commercial offering or the creation of a combined solution involving several partners. Research exploitation may include further technology development, validation in new applications, use in future collaborative projects or the expansion of a partner's established research line. Other results may support workforce development, customer engagement, scientific positioning, standardisation, dissemination or the demonstration of expertise.

This broader interpretation is particularly relevant to FLASH-COMP because its results form an interconnected portfolio. Some components can potentially be used independently, while others gain greater value through integration. The project has generated individual monitoring, simulation, data-management and decision-support capabilities, as well as testbeds, demonstrators, assessment methodologies, training materials and scientific knowledge. Exploitation planning must therefore consider both the individual value of each result and the value created when complementary results are brought together.

2.3. Identification and classification of results

The classification of FLASH-COMP results was developed through consortium discussion and an assessment of the results' maturity, commercial readiness, development potential and strategic value to the responsible partners. This process identified five Key Exploitable Results, five Exploitable Results and three Usable Results.

The agreed portfolio is summarised in Table 1, below.

Table 1. Categorisation of specific FLASH-COMP results and their exploitation pathways

Category	Agreed results	Principal planning output
Key Exploitable Results	MSI Data Platform; INEGI Simulation Tool; Combined Decision Support System; adapted Inspection and Monitoring Tools; combined	Full business plans



	inspection and monitoring hardware-software solution	
Exploitable Results	AI-based Defect Estimation Tool or FLASH-DSET; Data Augmentation Dynamics; INEGI Testbed; industrial Demonstrators; Manufacturing Sustainability Assessment Methodology	Development action plans
Usable Results	Training Modules; Standardisation Roadmap; Scientific Publications	Competitiveness and continued-use strategies

The classification provides a common basis for exploitation planning but is not intended to present the portfolio as a set of completely separate assets. Several results are technically or commercially interdependent. The relationship between individual and combined exploitation is therefore considered alongside the planning for each result.

2.4. Key Exploitable Results

Key Exploitable Results are the project results assessed as having the clearest commercial potential. They are considered ready for detailed business planning and for the development of immediate or near-term routes towards market exploitation.

Being ready for business planning does not necessarily mean that every KER is already a finished product available for immediate sale. A result may still require additional validation, production planning, integration, configuration for a particular industrial environment or agreement between the partners whose technologies contribute to it.

KER status means that there is sufficient technical progress and commercial potential to justify a structured assessment of how the result can be brought closer to the market.

Each KER will therefore be supported by a business plan addressing:

- The solution, its purpose and the industrial problem it addresses;
- Its development status, validation evidence and Technology Readiness Level;
- Its novelty and value proposition;
- Target markets, customers, decision-makers and use cases;
- The proposed commercial model and route to market;
- Standalone and bundled exploitation options;
- Foreground and background intellectual property;
- Ownership, access rights and any restrictions on exploitation;
- Dependencies on other partners or FLASH-COMP components;
- Capabilities and resources required for commercialisation;
- Principal costs and potential revenue models;
- Technical, operational and market risks;
- Post-project actions, milestones and indicative timescales.

The five KERs comprise both independently exploitable technical components and integrated offerings. MSI's Data Platform is a generic, sector-independent architecture that can be replicated across different industrial sectors. It does not include process-specific data, data models or algorithms. The Combined DSS is a separate result created by combining this platform with process-specific data and models, INEGI's simulation capability, LORTEK's AI and analytical contributions, and the DSS, HMI and



decision-support functionality. Individual inspection and monitoring technologies may similarly retain standalone routes while also contributing data to the integrated system.

The KER business plans will examine these alternative routes rather than assuming that one commercial model is appropriate for every result.

2.5. Exploitable Results

Exploitable Results are results with potential for further development towards commercial use or continued exploitation through research and collaboration. They have demonstrated value but are not yet considered sufficiently developed, validated or commercially defined to require the same level of business planning as the KERs.

For these results, the immediate priority is to define how they can advance to the next stage. Depending on the result, this may involve increasing its TRL, undertaking further industrial validation, adapting it to additional applications, integrating it into another solution, securing further funding, developing a service offering or using it as the basis for collaborative research.

Each ER will therefore be supported by an action plan covering:

- The result and the problem it addresses;
- Its current maturity and validation status;
- Its potential applications and target sectors;
- Its innovative or strategic value;
- The development, testing and validation still required;
- Funding or resource requirements;
- Commercial, research or collaborative exploitation routes;
- Possible integration into other FLASH-COMP or external solutions;
- Ownership, intellectual property and access considerations;
- Partner and external dependencies;
- Actions, milestones and timescales for reaching the next stage.

This approach recognises that exploitation can begin before a result reaches the market. The use of an ER in a new research project, an industrial trial, a consultancy assignment or a combined technical offering can advance its maturity and generate evidence for subsequent commercialisation.

2.6. Usable Results

Usable Results are project outcomes that are not currently intended to become standalone commercial products but which retain clear value for the partners and wider stakeholder community. They enhance knowledge and capabilities, support existing activities, demonstrate expertise and contribute to future collaboration, training, positioning and research.

The FLASH-COMP Usable Results include the Training Modules, Standardisation Roadmap and Scientific Publications. Their exploitation should not be assessed principally through expected sales or revenue. Their value lies in how they continue to be used and the wider benefits they create.

Each UR will therefore be supported by a competitiveness and continued-use strategy covering:

- The nature and purpose of the result;
- Its current and intended users;
- How it strengthens the responsible partners' capabilities;



- How it supports market, industrial or scientific positioning;
- Its value for training, knowledge transfer or professional development;
- Its role in supporting existing services and offerings;
- Its potential to generate collaboration or future projects;
- Possible improvements or further development;
- The steps required to maintain and increase its usability.

For example, **training materials** can support the adaptation of industrial operators and students to new digital manufacturing technologies. **Scientific publications** can strengthen the visibility and credibility of the contributing organisations and provide a basis for further research. **The Standardisation Roadmap** records the project's analysis of the relevant standards landscape and can help future activities avoid unnecessary duplication, even where no immediate requirement for a new standard has been identified.

2.7. Individual and integrated exploitation

A defining feature of the FLASH-COMP portfolio is the relationship between individual technologies and the combined system – from defect detection to decision support. This means that although the project's data-management, simulation, inspection, monitoring and decision-support capabilities are connected, this does not mean that every result must follow a single joint exploitation route.

Some results may be offered independently where they can operate with existing industrial infrastructure or third-party technologies. Others may be incorporated into a partner's established platform, service or research activity. In several cases, however, integration may create a stronger proposition by enabling data to be collected, processed, interpreted and presented to operators through a coordinated system.

The Combined Decision Support System is the clearest example of integrated exploitation. MSI's Data Platform supplies the generic digital architecture, while process-specific data, data models and algorithms, simulation, AI, DSS rules and HMI functionality create the application-specific decision-support solution. For FLASH-COMP, these contributions are associated principally with MSI, INEGI and LORTEK. The constituent technologies retain independent exploitation potential, while their integration creates a more complete solution for monitoring and supporting liquid resin infusion processes. The Combined DSS is jointly owned by MSI, INEGI and LORTEK. INEGI is the proposed main exploiter for composite-manufacturing applications, although ownership shares, delivery responsibilities and MADE's role remain to be confirmed.

Exploitation planning will therefore examine:

- Standalone exploitation by an individual partner;
- Integration into an existing partner offering;
- Bilateral or multilateral exploitation involving project partners;
- Licensing or technology transfer to an external integrator;
- Use within future research and industrial demonstration projects;
- Development of customised solutions for particular industrial users.

Where joint exploitation is proposed, the relevant partners will need to agree responsibilities, intellectual-property arrangements, access rights, development commitments, commercial leadership and the basis for sharing costs and returns. These matters will be addressed using information provided through the completed partner questionnaires and subsequent discussions.



2.8. Evidence and partner involvement

The exploitation plans are being developed from several complementary sources of evidence. Project technical reports provide information on the development, integration, validation and maturity of the results. Existing market research provides an initial view of the ZDM landscape, relevant industrial sectors, enabling technologies, market drivers, barriers and potential customers. Consortium discussions have informed the classification of the results and identified possible standalone and integrated exploitation routes.

The responsible partners each completed questionnaires tailored to each result category. KER questionnaires collected the information required for detailed business planning, including value propositions, markets, business models, intellectual property, resources, costs, risks and commercialisation roadmaps. ER questionnaires focussed on development requirements, future applications, integration, collaboration and progression to the next maturity level. UR questionnaires established how results will be used to strengthen capabilities, positioning, training, knowledge transfer and future collaboration.

The completed questionnaires have provided the primary source for statements about ownership, access rights, commercial intentions, resource commitments and post-project actions. This ensures that the resulting plans reflect the capacities and intentions of the organisations responsible for exploitation.

2.9. Relationship with stakeholder engagement and marketing

Exploitation planning is closely connected to the project's stakeholder analysis, communication and marketing activity. FLASH-COMP has segmented its audience across relevant industrial, research, policy, standards, workforce, public and media groups. This enables communication concerning individual results to be directed towards stakeholders with a demonstrated interest in ZDM, composite manufacturing and industrial digitalisation.

The marketing approach differs according to the type of result. Communication concerning KERs will focus on their industrial applications, value propositions and commercial potential. Communication concerning ERs will place greater emphasis on opportunities for validation, technical development and collaboration. UR communication will demonstrate the partners' knowledge, capabilities and contribution to ZDM and industrial digitalisation.

This connection between exploitation and stakeholder engagement will help the project identify potential customers, users, integrators, research collaborators, funders and other organisations capable of supporting the next stage of each result.

2.10. Planning outputs and next stages

The tailored planning process has delivered three complementary sets of outputs:

- Full business plans for the KERs;
- Development action plans for the ERs;
- Competitiveness and continued-use strategies for the URs.

These individual plans are supported by an analysis of cross-cutting opportunities and dependencies across the portfolio. This includes the potential for an integrated Decision Support System, combined inspection and monitoring offerings, common industrial-validation requirements, shared funding needs and opportunities for continued collaboration between FLASH-COMP partners.



The result is a project-level exploitation strategy that explains not only what FLASH-COMP has produced, but also how each result can continue to generate value, who will be responsible for taking it forward and what technical, commercial or collaborative steps are required after the project.

3. FLASH-COMP AND ITS RESULTS

3.1. Industrial challenge and project objective

Liquid resin infusion is used to manufacture large and complex composite components for sectors including marine and aerospace. The process involves the movement of resin through dry fibre reinforcement under vacuum, followed by curing. Variations in materials, tooling, process configuration and environmental conditions can affect resin flow and part quality. Defects or process deviations may not become apparent until a component has been completed, at which point corrective action can be difficult, expensive or impossible.

Conventional quality-control approaches often rely on inspection after production. This can identify whether a completed component meets the required standard, but it does not necessarily provide operators with information early enough to prevent a defect from developing. For large, high-value composite parts, a failed or defective production cycle can result in wasted materials, additional energy consumption, reworking, extended production time and increased cost.

FLASH-COMP was established to develop a fast, reliable and human-oriented quality-control solution capable of identifying relevant process conditions during liquid resin infusion and supporting timely corrective action. Its objective is to contribute towards zero-defect manufacturing by combining process monitoring, data collection, simulation, analysis and operator-oriented decision support.

The project has addressed this challenge as an integrated technical and organisational problem. **Effective defect prevention requires appropriate sensors and inspection systems, but also requires the resulting data to be transmitted, processed, interpreted and presented in a form that operators can use.** The project has therefore worked across the complete chain, from physical monitoring and data acquisition to simulation, decision support, industrial validation, sustainability assessment and skills development.

3.2. FLASH COMP technical concept

The FLASH-COMP concept brings together several complementary layers. These layers perform different functions and have produced results that may be exploited individually or as part of an integrated system.

Inspection and monitoring

The FLASH Inspection and Monitoring tools, referred to collectively as FLASH-IM, provide information about the liquid resin infusion process and the component being manufactured. The technologies investigated and adapted through the project include matrix and multispectral cameras, LiDAR and three-dimensional profiling, fibre-optic sensors and printed Pyzoflex sensors.

These technologies address different monitoring requirements. Fibre Bragg Grating and All Grating Fibre sensors have been used to obtain information relating to vacuum, resin arrival, flow progression and curing. Visual and spectral systems have been investigated for process and material monitoring, while profiling and LiDAR technologies provide geometric information. The value of the monitoring



layer lies not only in the hardware but also in the methods, software and algorithms required to configure the devices, process their signals and interpret the resulting data within an LRI manufacturing context.

Data management and interoperability

MSI's Data Platform provides the generic digital architecture through which heterogeneous industrial information can be acquired, normalised, stored and made available to other applications. The exploitable platform result does not include the process-specific data, data models, simulation models or analytical algorithms used in a particular deployment. These elements are connected to the platform as application-specific components.

Within the integrated testbed, data are received through MQTT and processed and normalised using Node-RED. Different databases are used according to the type and purpose of the information, including InfluxDB, MongoDB and PostgreSQL. Processed information is forwarded to the MSI platform hub, which provides shared platform services and supports communication with the operator-facing web application.

The architecture separates continuously operating data processing from the user interface. This allows the processing and decision-support functions to operate on the server side while the operator interface receives the relevant information and alerts. It also enables components to be modified or replaced without requiring the entire system to be redesigned. The implementation demonstrates the FLASH-COMP configuration but does not make LRI-specific data or models part of MSI's underlying Data Platform ownership.

Simulation and hybrid twins

FLASH-COMP has developed and tested simulation capabilities for the resin-infusion process. These include reduced-order and LIMS-based hybrid-twin approaches intended to support simulations at a speed appropriate for process monitoring and decision support.

The simulation layer uses information concerning factors such as component geometry, materials and process conditions to represent expected infusion behaviour. Sensor feedback can be used to improve or calibrate the representation of the live process. This provides a basis for comparing observed process behaviour with expected behaviour and for identifying conditions that may require attention.

The simulation tools constitute a distinct technical result, but they also form an important input to the wider decision-support concept. Their exploitation may therefore be considered both independently and through integration with data-management and operator-interface technologies.

Defect estimation and data processing

The FLASH Defect Severity Estimation Tool, or FLASH-DSET, represents the project's work on using data-processing and machine-learning approaches to identify and assess possible defects. The purpose of this layer is to move beyond the collection of raw monitoring data and extract information that can support defect identification, estimation and subsequent action.

The project has adapted its data-processing and defect-estimation work to composite manufacturing and LRI applications. Further development and application beyond the project will depend on the



availability and quality of relevant process data, continued algorithm training and validation in additional manufacturing conditions.

Decision support and operator interface

The FLASH Decision Support System, or FLASH-DSS, brings together MSI's generic Data Platform with process-specific data, simulation and analytical models, AI and defect-estimation capabilities, DSS rules, HMI functionality and operator-oriented presentation. The resulting Combined DSS is therefore broader than either the MSI's Data Platform or INEGI's Simulation Tool considered independently.

Within the digital testbed, DSS rules operate mainly on the server side and generate standardised alerts with contextual information. These alerts are transmitted through the platform hub to the front-end web application. The front end was integrated as a native module of the MSI industrial platform, reusing common functions including authentication, alarms and messaging. For exploitation purposes, the application-specific DSS and HMI functionality are distinguished from MSI's generic platform architecture. The Combined DSS is jointly associated with MSI, INEGI and LORTEK rather than being treated as an MSI platform feature alone.

The purpose of the DSS is not simply to display data. It is intended to transform the outputs of different technical components into information that supports process understanding and decision-making. This distinction is important to the project's human-oriented approach: the effectiveness of the system depends on the relevance, clarity and timing of the information provided to the operator.

3.3. Integrated system and data flow

The FLASH-COMP system can be described as an end-to-end chain connecting the physical manufacturing process with digital analysis and operator support.

Manufacturing process and monitoring devices → process-specific data acquisition → MSI generic Data Platform → process-specific simulation, data models and AI algorithms → DSS rules and decision-support functions → HMI and operator action

The monitoring devices capture information from the manufacturing process. Process-specific sensor and camera data are transmitted using defined communication protocols and converted into consistent formats. MSI's generic Data Platform processes, stores and exchanges the information, while application-specific simulation and analytical components interpret it. DSS rules then generate alerts or other contextual information for presentation through the HMI. This structure distinguishes the reusable, sector-neutral platform architecture from the process knowledge and analytical functions required for a particular application.

The architecture supports three principal modes:

- Real-time monitoring of an active manufacturing process;
- Historical replay of stored production campaigns and their associated DSS events;
- Training or simulation using previously collected or generated data.

These modes use a common software base but are separated within the architecture. Historical replay and training data are isolated from the live alarm pipeline so that simulation or review activity cannot generate false alerts within an active manufacturing process.



The architecture also follows a multi-factory approach. Process, sensor and historical data can be accessed through defined interfaces and shared with external digital environments where appropriate. This supports interoperability and creates the technical basis for applying the system in more than one manufacturing location.

Although the integrated chain demonstrates how the components work together, it does not require every component to be commercialised as part of a single package. The modular design makes it possible to consider standalone simulation, monitoring or data-platform applications alongside the combined DSS opportunity.

3.4. Physical and digital testbeds

FLASH-COMP developed physical and digital testbed capabilities to integrate, test and validate its technologies before and alongside industrial use-case activity.

Physical testbed

The physical testbed provided a controlled environment for testing monitoring technologies, materials, process configurations and data acquisition. Trials using representative tooling enabled the partners to assess sensor placement, ancillary materials, infusion configurations and signal performance under increasingly realistic conditions.

Fibre-optic technologies were tested in different positions and configurations to examine their ability to detect relevant process events. Additional tests generated data covering different process conditions and local defects for analysis and algorithm development. Collaborative work also included spectral imaging trials and tests linking physical monitoring with simulation activities.

The physical testbed therefore performed several roles. It supported technical validation, generated data for processing and model development, enabled integration between partner technologies and provided a bridge between laboratory development and larger industrial demonstrations.

Digital testbed

The digital testbed integrated the process-data pipeline, simulation information, databases, DSS functions and operator interface. It established an end-to-end digital chain from data acquisition to operator-oriented information.

The architecture supports real-time communication, campaign-based data storage, standardised DSS alerts and historical replay. The complete digital chain was exercised using data from the AZIMUT industrial trials. This demonstrated interoperability between heterogeneous data sources, server-side processing, decision-support functions and the operator-facing application.

Together, the physical and digital testbeds provide a reusable environment for further experimentation, training, demonstration and research. Their exploitation value extends beyond the validation completed within FLASH-COMP because they can support the testing and integration of future technologies and applications.

3.5. Industrial validation and demonstrators

FLASH-COMP applied and validated its technologies through two industrially relevant composite-manufacturing use cases: large yacht components associated with **AZIMUT** and an aerospace wing-box demonstrator associated with **IAI**.



The use cases allowed the project to move beyond controlled laboratory conditions and examine the practical requirements of deployment. These included equipment positioning, sensor robustness, environmental variability, data transmission, spatial calibration, operator interaction and the need to maintain consistent configurations across repeated manufacturing trials.

AZIMUT marine use case

The AZIMUT use case provided industrial trial data for exercising the complete digital architecture. These data were used to test the path from acquisition and normalisation through storage and DSS processing to operator visualisation.

The exploitation document should therefore limit its claims at this stage to the evidenced use of AZIMUT trial data within the digital testbed and incorporate further results when the final technical reporting or completed partner information becomes available.

IAI wing box use case

The aerospace use case involved the manufacture of a full-scale 1.2-metre wing-box demonstrator using materials and processing conditions defined with reference to IAI's manufacturing requirements. AIMEN designed and manufactured specific tooling for preforming and infusion, while sensor positioning was selected to monitor critical regions of the component.

Fibre Bragg Grating and All Grating Fibre sensors were positioned at the mould surface and above the process consumables. The trials demonstrated the collection of process information associated with vacuum conditions, resin-flow progression and curing. Several demonstrators were manufactured to refine sensor positioning and infusion conditions and to achieve an acceptable final component.

AIMEN also developed a digital tool to prepare FOS data for transmission to the FLASH-COMP platform, including metadata concerning sensor type, position, channel allocation and evaluation points. Complementary work used a three-dimensional profiler and matrix camera to collect geometric and visual information.

The final wing-box validation activity brought together AIMEN, LORTEK, INEGI and IAI and demonstrated the FLASH-IM technologies within the full-scale manufacturing process.

Industrial implementation lessons

The validation activity identified several requirements that remain relevant to exploitation:

- Optical scanners, LiDAR and profilometers require controlled trajectories, suitable mounting and coverage planning when applied to complex geometries;
- Lighting, reflections, surface conditions, wrinkles and physical obstructions can affect optical-data quality;
- Information from different monitoring systems requires alignment with a common spatial reference, including the relevant CAD model;
- Changes to geometry, materials, lighting, sensor position or process configuration must be recorded and may require revalidation;
- Some monitoring technologies still require specialist configuration, assembly or calibration;
- Repeated movement and reassembly of equipment can disturb previously established spatial relationships.



These findings do not reduce the value of the results. They define the engineering, configuration and training work required to progress from successful project validation towards repeatable industrial deployment.

3.6. Sustainability and human centred implementation

FLASH-COMP's technical development has been accompanied by work addressing sustainability, organisational readiness and human skills.

The project developed an assessment framework covering product and process eco-efficiency, digital-transformation maturity and the human implications of adopting the FLASH-COMP solution. Resin infusion was identified as a particularly important process for assessment because of its material, operational and worker-related impacts.

POLIMI developed the ZDM Maturity Model around six dimensions: Product, Process, Platform, People, Partnership and Performance. The methodology uses maturity levels to examine an organisation's readiness for digital transformation and the implementation of ZDM approaches. It was applied to the AZIMUT and IAI use cases through questionnaires and follow-up interviews, allowing quantitative findings to be reviewed alongside the industrial partners' explanations and experience.

The project also conducted skills-gap analysis with the industrial partners. This considered how the introduction of monitoring, data and decision-support technologies could change operators' activities and responsibilities and what competencies would be required to use the resulting system effectively. The findings informed the definition of learning paths and training materials for industrial operators and higher-education students.

This work supports exploitation in two ways. First, it helps potential users understand that successful technology adoption requires attention to processes, skills and organisational capability as well as hardware and software. Second, it has generated methodologies and training resources that can continue to be used independently of the complete technical system.

3.7. Principal achievements and maturity

The technical report records substantial progression in the maturity of the project's principal technical results.

Table 2. TRL level predictions based on technical reporting

Result or capability	Principal achievement	Reported final TRL	Remaining considerations
Multispectral linear cameras	Adaptation of machine-vision devices and spectral filtering for monitoring relevant material or process characteristics	7	Application-specific configuration and validation
FLASH LiDAR	Adaptation of LiDAR-based high-precision geometric monitoring for large composite structures	6	Industrial mounting, motion control, calibration and environmental robustness



Fibre-optic sensors	Integration of distributed FOS technologies for in-line monitoring of LRI processes	6	Simplified handling, repeatable installation and operator-oriented calibration
Pyzoflex sensors	Integration of printed sensors into large-area and complex composite-manufacturing processes	6	Further application and industrial validation
MOR-based Hybrid Twins	Real-time reduced-order simulation of complex physical phenomena associated with infusion	6	Continued validation and integration with industrial data
LIMS-based Hybrid Twin for resin infusion	Real-time infusion simulation with permeability calibration informed by sensor feedback	7	Productisation and configuration for additional industrial applications
FLASH-COMP solution for traditional composite manufacturing	Industrial feasibility demonstrated through two relevant use cases	7	Repeatability, deployment configuration and commercial integration
FLASH-COMP solution for emerging bio-based composites	Application of the concept to more environmentally oriented materials	6	Further material-specific development and validation
Digital testbed and DSS chain	End-to-end integration from heterogeneous data acquisition to DSS alerts and operator visualisation	6 at testbed integration stage	Finalisation of some industrial thresholds and further validation of selected data inputs

TRL provides an indication of technical maturity but does not by itself demonstrate commercial readiness. Further production optimisation, ownership, integration responsibilities, customer requirements, cost, ease of installation, regulatory considerations and the capacity of the responsible partners must also be assessed. These issues are addressed through the exploitation plans rather than inferred from TRL alone.

3.8. From technical outputs to exploitable results

The technical work described in this chapter has generated a portfolio rather than a single product. The portfolio includes monitoring technologies, data infrastructure, simulation and analytical capabilities, decision-support functions, testbeds, demonstrators, assessment methodologies, training materials and scientific knowledge.

The transition from technical output to exploitable result depends on how each asset can be used after the project. Some technical components have been classified as KERs because they support defined commercial propositions or integrated offerings. Other results require additional development, validation or collaboration and are treated as ERs. Training, standardisation and scientific outputs are treated as URs because their principal value lies in continued use, knowledge transfer and competitive or scientific positioning.



4. FLASH-COMP'S EXPLOITATION PORTFOLIO

4.1. Portfolio overview

FLASH-COMP has produced a portfolio of interrelated technical, methodological and knowledge-based results. The portfolio includes technologies with defined commercial potential, results requiring further development or validation and outputs whose principal value lies in continued use, capability building and strategic positioning.

The portfolio has been organised into five Key Exploitable Results, five Exploitable Results and three Usable Results. This structure allows each result to be planned according to its maturity and intended form of exploitation while retaining a clear view of the relationships between them.

The results do not constitute thirteen entirely separate assets. Several represent individual components and the wider integrated solutions that can be created by combining those components. The portfolio therefore supports more than one exploitation route:

- Standalone use or commercialisation of an individual technology;
- Incorporation of a result into a partner's existing product, platform or service;
- Joint exploitation involving two or more FLASH-COMP partners;
- Integration within the wider Decision Support System;
- Further development through industrial research or collaborative projects;
- Use for training, demonstration, marketing, knowledge transfer or organisational positioning.

The responsible partners identified in this chapter reflect the allocation recorded in the project documentation. Final ownership, background and foreground intellectual property, access rights and authority to exploit each result will be confirmed through the completed partner questionnaires and any subsequent agreements required between the organisations involved.

4.2. Key Exploitable Results

The five KERs represent the results with the clearest potential for market-oriented exploitation and are therefore subject to full business planning.

KER 1 Data Platform

Responsible partner, owner and main exploiter: MSI, 100%

The Data Platform comprises the generic architecture for acquiring, harmonising, storing, managing and exchanging industrial data. It provides a reusable digital foundation to which industrial equipment, sensors, databases, analytical tools and user applications can be connected. The result does not include sector- or process-specific data, data models, simulation models or algorithms. Within FLASH-COMP, these application-specific elements were connected to the platform to support liquid resin infusion, but they remain distinct from MSI's generic platform result.

MSI is the sole owner and main exploiter of the Data Platform. Its principal opportunity is deployment and configuration across different industrial sectors and production environments. Potential replication areas identified by MSI include composites, paper, steel and other data-intensive manufacturing sectors.



The Data Platform forms the generic digital foundation for KER 3, the Combined DSS, but remains a distinct MSI-owned result. It is also related to ER 2, Data Augmentation Dynamics, and can receive data from the technologies represented by KER 4 and KER 5.

Potential exploitation routes:

- Deployment through MSI's industrial integration activities;
- Software licensing, maintenance and support;
- Configuration for customers in different manufacturing sectors and integration with third-party equipment, models and analytical tools;
- Use as the generic digital foundation within the Combined DSS;
- Replication in paper, steel and other industrial processes and markets.

KER 2 Simulation Tool

Responsible partner: INEGI

The Simulation Tool comprises algorithms and models that process information concerning the LRI process and represent expected infusion behaviour. The project has developed real-time simulation and hybrid-twin capabilities, including approaches that can incorporate sensor feedback.

The underlying value lies in the simulation and processing capability rather than dependence on one particular camera, sensor or user interface. The tool can potentially operate with compatible data from existing factory systems or other technology providers. It may therefore have a standalone exploitation route as a simulation engine, while also providing greater operator value when connected to a data platform and interface.

The Simulation Tool is one of the two central components of KER 3. It can also use inputs from the monitoring technologies represented by KER 4 and KER 5 and may contribute to the further development of ER 1, the FLASH-DSET.

Potential exploitation routes:

- Standalone simulation or modelling service;
- Licensing or integration of the simulation engine;
- Customised implementation for an industrial user;
- Integration with MSI's Data Platform;
- Use in future research and industrial-validation projects.

KER 3 Combined Decision Support System

Responsible partners and owners: MSI, INEGI and LORTEK. Shared ownership is confirmed in principle; the precise ownership percentages remain to be agreed.

The Combined Decision Support System comprises MSI's generic Data Platform together with process-specific data, data models and algorithms, INEGI's simulation and composite-process expertise, LORTEK's AI and analytical contributions, and the DSS, HMI and decision-support functionality required to support operators.



The Combined DSS is a distinct result from the MSI's Data Platform. The platform supplies the generic architecture, while the Combined DSS adds the application-specific knowledge and functionality needed to interpret process behaviour and support decisions in composite manufacturing.

The DSS should be understood as a configurable system rather than a fixed package containing every FLASH-COMP technology. Its composition may vary according to the process, infrastructure, available data and required intelligence. Shared ownership is attributed to MSI, INEGI and LORTEK, with the precise allocation, potentially 33% each, still to be formally confirmed.

INEGI is the proposed main exploiter because of its focus on composite manufacturing and its ability to lead application-specific deployment. MSI and LORTEK would contribute their respective technologies within the integrated offer. Responsibilities for customer engagement, integration, delivery and support must be agreed, and MADE's potential role must be confirmed directly with MADE.

Potential exploitation routes:

- An INEGI-led DSS for LRI composite manufacturing, supported by MSI and LORTEK;
- Joint delivery by INEGI, MSI and LORTEK using a customer-specific configuration;
- Integration with monitoring devices already installed at a customer's facility;
- Customised implementation and support services;
- Further validation and productisation through collaborative industrial projects.

KER 4 Adapted Inspection and Monitoring Tools

Responsible partners: INEGI for camera-based monitoring; LORTEK for hyperspectral imaging; CSEM for LiDAR; AIMEN for fibre-optic sensing; and JOR for Pyzoflex sensing, subject to confirmation.

This KER comprises individual inspection and monitoring technologies adapted or developed for use in LRI composite manufacturing. The technologies include matrix and multispectral cameras, hyperspectral imaging, LiDAR and three-dimensional profiling, fibre-optic sensors and printed Pyzoflex sensors.

Some of the physical devices are standard or originate from applications outside composite manufacturing. The FLASH-COMP result lies in their adaptation, configuration and integration for LRI, together with the software, algorithms, processing methods and implementation knowledge required to extract useful process information.

The tools address different monitoring needs and do not necessarily have to be deployed together. Each may have an individual exploitation pathway based on its technical maturity, ownership and application. They can also provide data to the Data Platform, Simulation Tool and DSS.

Potential exploitation routes:

- Individual sensor or imaging solutions for defined monitoring requirements;
- Hardware supplied with application-specific software and algorithms;
- Engineering and integration services;
- Licensing or technology transfer to equipment providers and systems integrators;
- Use within future research and industrial-validation projects;
- Inclusion within the combined monitoring solution represented by KER 5.



KER 5 Combined Inspection and Monitoring Hardware and Software Solution

Responsible partners: The partners responsible for the relevant monitoring technologies, subject to confirmation of the proposed configuration and exploitation arrangement

This KER represents the integrated solution created by combining selected inspection and monitoring devices with the software, algorithms and implementation knowledge developed through FLASH-COMP.

Its distinction from KER 4 is one of system level. KER 4 concerns the exploitation of the individual monitoring technologies, while KER 5 concerns their combination into a coordinated hardware-software package. The package could be configured according to the component geometry, manufacturing process, required measurements and customer infrastructure.

The full package would not necessarily include every monitoring technology tested by FLASH-COMP. A commercial or industrial deployment could select the most appropriate combination of cameras, LiDAR, profiling or embedded sensors and connect them to the required data-processing and presentation environment.

Potential exploitation routes:

- A customised monitoring package for LRI manufacturing;
- Integration by a specialist engineering or automation provider;
- Joint delivery by selected technology-owning partners;
- Supply as a monitoring layer for the combined DSS;
- Demonstration and further validation through industrial projects.

4.3. Exploitable Results

The five ERs have defined exploitation potential but require further development, validation, integration or strategic preparation. Each will be supported by an action plan rather than a complete commercial business plan at this stage.

ER 1 Defect Estimation Tool or FLASH DSET

Responsible partner: LORTEK

The FLASH-DSET is a machine-learning and data-processing result intended to support the identification and estimation of defects in composite manufacturing. Through FLASH-COMP, the work has been adapted towards LRI applications and advanced from its earlier maturity level.

The result may become commercially relevant through continued algorithm development, access to suitable training data and validation across a broader range of materials, geometries and industrial conditions. It may also contribute analytical intelligence to the DSS or be incorporated into another manufacturing-quality system.

Relationship to the portfolio: The FLASH-DSET uses data originating from monitoring and inspection technologies and may provide processed defect information to the MSI's Data Platform and DSS.

Principal next-stage routes:

- Further algorithm training and industrial validation;
- Integration with the FLASH-COMP DSS;



- Adaptation to additional composite-manufacturing applications;
- Collaborative research on AI-based defect estimation;
- Incorporation into LORTEK's existing research or service activities.

ER 2 Data Augmentation Dynamics

Responsible partner, owner and main exploiter: MSI, 100%

Data Augmentation Dynamics is an MSI-owned environment for creating process-specific synthetic data for AI development, simulation and validation. It addresses situations in which real industrial datasets are limited, incomplete, expensive to generate or insufficiently representative of the scenarios required for model development.

MSI is the sole owner and main exploiter. The environment may be applied within MSI's AI, simulation and industrial-digitalisation activities, incorporated into paid development projects or used as an enabling capability within a wider analytical or DSS implementation. The use of partner or customer data remains subject to the ownership, confidentiality and permitted-use conditions applying to the source datasets.

Relationship to the portfolio: The result supports AI development, simulation and validation and may strengthen the Simulation Tool, FLASH-DSET or Combined DSS without changing MSI's ownership of the environment.

Principal next-stage routes:

- Integration within MSI's AI and industrial-analytics portfolio;
- Creation of synthetic data for AI, simulation and model validation;
- Use in paid industrial or collaborative development projects;
- Application across additional processes and industrial sectors;
- Contribution to Combined DSS developments where additional training or validation data are required.

ER 3 INEGI Testbed

Responsible partner: INEGI

The INEGI testbed provides an environment in which sensors, cameras, data acquisition, analysis, simulation and decision-support technologies can be tested and demonstrated. It enables the partners and external stakeholders to observe how the individual components and integrated chain operate under representative manufacturing conditions.

The testbed is not expected to be sold as a conventional product. Its exploitation value comes from the activities it enables. It can be used to demonstrate technologies to industrial organisations, support training, provide proof of concept, generate data and validate further developments.

Relationship to the portfolio: The testbed supports the development and demonstration of the KERs and other ERs and provides a practical environment for testing integration between them.

Principal next-stage routes:

- Industrial demonstrations and customer engagement;
- Contract research and technology-validation services;



- Training for researchers and industrial personnel;
- Use in future regional, national or European projects;
- Expansion of INEGI's research activities in monitoring, simulation and ZDM.

ER 4 Industrial Demonstrators

Responsible partners: AZIMUT and IAI

The demonstrators provide tangible evidence of applying FLASH-COMP technologies to industrially relevant marine and aerospace composite-manufacturing scenarios. They illustrate how monitoring, data collection, analysis and related ZDM approaches can be incorporated into the manufacture of large composite components.

The demonstrators are not intended to become standalone products. Their value lies in showing what was achieved, supporting internal uptake, strengthening external credibility and providing evidence for future technical and commercial activity.

Relationship to the portfolio: The demonstrators provide the industrial context in which the KER technologies and integrated concepts can be presented and assessed.

Principal next-stage routes:

- Demonstration of advanced manufacturing capability to potential clients;
- Internal transfer of project learning towards production activity;
- Presentation of sustainability and waste-reduction ambitions;
- Support for marketing, business development and brand positioning;
- Evidence for future research, innovation and collaborative proposals.

ER 5 Manufacturing Sustainability Assessment Methodology

Responsible partner: POLIMI

The Manufacturing Sustainability Assessment Methodology includes the ZDM Maturity Model developed around the six dimensions of Product, Process, Platform, People, Partnership and Performance. It supports assessment of an organisation's readiness for digital transformation and ZDM implementation, including gaps in technology, processes, skills and organisational capability.

The methodology can help an organisation understand its current position and identify actions required to progress. It can be used in research, industrial assessment or consultancy contexts and has potential to support other projects and sectors.

Relationship to the portfolio: The methodology complements the technical results by addressing the organisational and sustainability conditions required for successful adoption.

Principal next-stage routes:

- Consultancy or assessment services;
- Application within other research and innovation projects;
- Adaptation to further industrial sectors;
- Support for digital-transformation and ZDM roadmaps;
- Continued methodological research and publication.



4.4. Usable Results

The three URs create value through continued use rather than direct standalone commercialisation.

UR 1 Training Modules

Responsible partner: ESTIA, with technical input from relevant partners

The Training Modules translate FLASH-COMP knowledge into learning materials for industrial operators and higher-education students. They address the skills and competencies required to understand and use technologies related to LRI, monitoring, data analysis, simulation, digital twins and ZDM.

The modules can support existing courses, new training activities, workforce development and the wider dissemination of project knowledge.

Continued-use routes:

- Incorporation into ESTIA's teaching and training activities;
- Adaptation for industrial workforce development;
- Use by project partners to explain FLASH-COMP technologies;
- Support for future research and education projects;
- Contribution to skills development in industrial digitalisation and ZDM.

UR 2 Standardisation Roadmap

Responsible partner: MADE, with consortium input and support from the standardisation activity

The Standardisation Roadmap records the project's analysis of standards relevant to digital manufacturing, ZDM and composite-manufacturing applications. The exercise included consideration of possible gaps and areas in which project results might contribute.

The analysis did not identify a sufficiently significant gap in composite manufacturing to justify developing a new standard through FLASH-COMP. This is itself a useful result. It documents the standards landscape and can help future projects and industrial activities avoid duplicating analysis or pursuing standardisation work without a demonstrated need.

Continued-use routes:

- Reference material for future research and industrial projects;
- Support for monitoring developments in ZDM standardisation;
- Evidence for decisions about whether further standardisation work is justified;
- Prevention of duplicated effort;
- Input to future standards activity if new gaps emerge.

UR 3 Scientific Publications

Responsible partners: All partners contributing to the relevant research

The scientific publications communicate technical and methodological findings generated through FLASH-COMP. They contribute to the knowledge base surrounding composite manufacturing, monitoring, simulation, artificial intelligence, machine learning, sustainability and ZDM.



Their value extends beyond the communication of individual findings. Publications support the credibility and scientific positioning of the contributing organisations and researchers and provide a basis for further research, collaboration and proposal development.

Continued-use routes:

- Dissemination of project knowledge;
- Academic and organisational positioning;
- Support for researchers' professional development;
- Creation of evidence for future proposals and collaborations;
- Stimulation of further technical and scientific work.

4.5. Relationships across the portfolio

The portfolio can be understood through four connected groups.

Digital decision support group

This group contains MSI's generic Data Platform, INEGI's Simulation Tool, LORTEK's DSET and analytical contributions, Data Augmentation Dynamics and the Combined DSS. The component technologies retain separate exploitation pathways, while the Combined DSS is created when relevant elements are integrated with process-specific data, models, algorithms, DSS rules, AI and HMI functionality.

The FLASH-DSET and Data Augmentation Dynamics provide further analytical and synthetic-data capability. Data Augmentation Dynamics is owned and exploited entirely by MSI, while rights relating to source datasets must be managed for each application.

Inspection and monitoring group

This group contains the individual adapted inspection and monitoring technologies and the combined hardware-software monitoring solution. Individual devices and associated processing methods may be exploited separately. Selected technologies may also be brought together as a configurable monitoring package or used as input sources for the DSS.

Validation and adoption group

The INEGI testbed, AZIMUT and IAI demonstrators and Manufacturing Sustainability Assessment Methodology help move the technical results towards wider use.

The testbed supports experimentation, validation, training and demonstration. The industrial demonstrators provide evidence of application in relevant manufacturing contexts. The assessment methodology addresses organisational readiness, sustainability and the changes needed to adopt ZDM and digital-manufacturing approaches.

Knowledge and positioning group

The Training Modules, Standardisation Roadmap and Scientific Publications support the longer-term use and diffusion of project knowledge. They contribute to skills development, research, collaboration, credibility and avoidance of duplicated work.



4.6. Portfolio dependencies and exploitation choices

- The principal portfolio dependencies are functional rather than absolute. For example:
- The Data Platform requires data inputs for each deployment but does not inherently include or own customer sector- or process-specific data and models;
- The Simulation Tool can potentially operate with compatible data and a different front end;
- The Combined DSS depends on integration of MSI's Data platform with process-specific data and models, INEGI's simulation capability, LORTEK's analytical and AI contributions, and the required DSS and HMI functions;
- The combined monitoring package depends on agreement between the owners of the selected hardware and software components;
- The FLASH-DSET depends on suitable data for algorithm training and validation;
- The testbed and demonstrators support exploitation but are not required to accompany every future sale or deployment;
- The sustainability methodology, training resources, roadmap and publications can be used independently of the technical system.

These relationships create flexibility, but they also require clear decisions. The partners have determined which results they intend to exploit independently, which they wish to combine and which activities require an external integrator, customer, funder or research collaborator.

The completed questionnaires have been used to establish:

- Confirmed ownership and access rights;
- The intended lead for each exploitation route;
- Partner willingness to participate in joint offerings;
- Technical and commercial dependencies;
- The availability of staff, infrastructure and finance;
- Preferred commercial, licensing, service or research models;
- Milestones and decision points for post-project activity.

4.7. Bridge to market and exploitation planning

The portfolio demonstrates that FLASH-COMP has generated more than one possible route to impact. It includes commercial components, integrated solution concepts, research and validation assets and results that strengthen the capabilities and position of the partners.

The following chapters assess the environment in which those results may be exploited. The market analysis examines the development of ZDM, relevant industrial sectors, customer needs, competitors, barriers and opportunities. The subsequent exploitation sections then apply that evidence to the individual KER business plans, ER action plans and UR competitiveness strategies.

This progression ensures that market claims and exploitation decisions are linked to identifiable project results. It also allows the plans to distinguish between:

- What has already been developed and validated;
- What remains to be developed;
- What can potentially be offered independently;
- What requires integration or partner agreement;
- What will create commercial value;
- What will create value through research, services, training, positioning or continued use.

In effect, this is the organising framework for the remainder of the exploitation strategy.



5. MARKET AND STAKEHOLDER LANDSCAPE

5.1. Purpose and scope

This chapter examines the external environment in which the FLASH-COMP results may be exploited. It considers the development of zero-defect manufacturing, the technology and service markets relevant to the portfolio, priority industrial sectors, potential customers and users, adoption drivers, barriers, competitors and the policy and funding environment.

FLASH-COMP does not address one single market. Its portfolio includes sensors and inspection technologies, industrial data platforms, simulation tools, algorithm-based analysis, decision support, testbed and demonstration services, maturity assessment and training. These results have different potential users, purchasing processes, competitors and routes to adoption.

The purpose of this chapter is therefore to establish a common market context for the portfolio. Detailed market positioning, customer evidence, pricing and commercial routes for individual KERs will be addressed in their respective business plans. ER and UR planning will use the same landscape to identify development partners, research opportunities, users and routes for continued use.

Market claims included in this draft are based on the existing FLASH-COMP market research. Where a claim requires an updated, independent or more authoritative reference, this is identified through a source marker and recorded in Section 5.11.

5.2. Zero defect manufacturing context

Zero-defect manufacturing is an approach to production that seeks to prevent defects or detect them early enough for corrective action to be taken. It differs from a model based principally on end-of-line inspection, where quality problems may only be discovered once materials, energy and production time have already been committed.

ZDM is supported by several connected capabilities:

- Monitoring process and product conditions;
- Collecting and managing production data;
- Identifying abnormal behaviour or conditions;
- Modelling and simulating expected process behaviour;
- Estimating the likelihood or severity of defects;
- Presenting relevant information to operators;
- Supporting feedback or feedforward corrective action;
- Learning from previous production campaigns.

The wider adoption of industrial sensors, connected equipment, data platforms, simulation, digital twins and artificial intelligence is creating the technical basis for more predictive and adaptive quality-control systems.¹

Manufacturers are also under pressure to improve material efficiency, production consistency and environmental performance while reducing cost and maintaining competitiveness. These pressures

¹ https://papers.ssrn.com/sol3/papers.cfm?abstract_id=7123559



strengthen the case for technologies that can identify process deviations before they produce scrap, rework or failed high-value components.²

The FLASH-COMP market research refers to a continuing gap between manufacturers' expectations for AI-enabled production and their present level of real-time process visibility. It cites a 2024 Zebra Technologies study reporting that 54% of European manufacturers expected AI to drive manufacturing growth by 2029, while only 15% reported real-time visibility across production. This is potentially useful evidence of an adoption gap.³

FLASH-COMP contributes to this field through its focus on LRI composite manufacturing. Its technical work demonstrates an end-to-end approach linking monitoring devices, data management, simulation, decision-support rules and an operator interface. **[Project evidence: RP3 Scientific Report, WP5 and WP6]**

5.3. Relevant technology and service markets

5.3.1 Industrial sensors and inspection systems

The market for industrial quality control includes embedded sensors, machine-vision systems, spectral imaging, laser-based measurement, three-dimensional profiling and non-destructive inspection technologies. These technologies differ in what they measure, when they can be applied and whether they monitor the manufacturing process, the material or the completed component.

For FLASH-COMP, the relevant opportunity is not limited to the sale of sensing hardware. Several of the devices tested through the project are already available commercially or derive from other application areas. The value created through FLASH-COMP lies in adapting them to LRI, determining suitable configurations and positioning, processing their data and integrating their outputs into a wider monitoring and decision-support environment. **[Project evidence: RP2 and RP3 Scientific Reports]**

The potential customer may therefore purchase a combination of equipment, software, configuration, integration and support rather than a new sensor alone. Market assessment for these KERs will need to examine both sensor manufacturers and systems integrators, as well as specialist providers of machine vision, process monitoring and non-destructive testing.⁴

5.3.2 Industrial data platforms

Industrial data platforms collect, structure, store and present information from production equipment and digital systems. Relevant functions include interoperability, real-time monitoring, alarm management, historical analysis, connectivity with existing factory systems and support for additional analytical or simulation applications.

The MSI's generic Data Platform developed and applied within FLASH-COMP operates in a market containing large industrial automation providers, industrial IoT platforms, manufacturing software suppliers and specialist integrators. Many potential users will already have data infrastructure. The commercial question is therefore whether MSI's architecture replaces, extends or connects with that infrastructure. It should be assessed as a reusable industrial data architecture rather than an LRI-

² https://papers.ssrn.com/sol3/papers.cfm?abstract_id=7123559

³ https://www.zebra.com/content/dam/zebra_dam/en/reports/vision-study/manufacturing-report-vision-study-connected-factory-en-us.pdf

⁴ <https://www.grandviewresearch.com/industry-analysis/machine-vision-market>



specific platform. MSI foresees replication in sectors including paper and steel, although these markets will require their own application evidence and configurations.

5.3.3 Simulation digital twins and hybrid twins

Simulation and digital-twin technologies allow manufacturers to represent processes or assets digitally, test scenarios and compare expected and observed performance. Hybrid approaches can combine physics-based models with live or historical data.

For LRI, simulation can support understanding of resin-flow behaviour and the effect of materials, geometry and process conditions. The FLASH-COMP simulation tools have progressed through real-time and sensor-informed approaches, creating potential for both standalone modelling and integration into a DSS. **[Project evidence: RP3 Scientific Report, TRL table and WP5]**

The relevant market includes engineering-simulation providers, composite-process modelling software, digital-twin platforms, specialist consultancies and internally developed manufacturer solutions⁵.

5.3.4 Artificial intelligence and defect estimation

AI and machine learning can be used to identify patterns, classify defects, estimate severity and support prediction using production and inspection data. Commercial adoption depends on the availability of representative data, model performance, explainability, integration and continued monitoring after deployment.

The FLASH-DSET represents an opportunity to extend defect estimation within composite manufacturing. Its future potential will depend on further training and validation across relevant materials, geometries and production conditions and the possible introduction of AI solutions.

5.3.5 Decision support systems

Industrial DSS solutions combine information from multiple sources and present recommendations, warnings or contextual information to operators and engineers. Their value depends on whether the information is timely, relevant, reliable and compatible with established working practices.

The FLASH-COMP Combined DSS sits across several technology markets because it combines a generic data architecture with process-specific data and data models, simulation, analytical algorithms, AI, DSS rules, HMI and operator presentation. It should therefore be compared with industrial-quality platforms, process-optimisation tools, composite-manufacturing engineering services and customised systems-integration projects rather than with a single standalone software market.

5.3.6 Assessment training and technical services

The FLASH-COMP portfolio also includes results that sit within service and knowledge markets. The ZDM Maturity Model could be used within consultancy, organisational assessment or digital-transformation support. The testbed can support contract research, validation, demonstration and training. Training modules can contribute to industrial skills development and higher education.

These markets are less likely to be described adequately through a single market-value estimate. Their potential should instead be assessed through comparable service offerings, established day rates or

⁵<https://www.mckinsey.com/industries/industrials/our-insights/digital-twins-the-key-to-smart-product-development>



project values, relevant training programmes, client demand and evidence from the responsible partners' existing activities. See chapters 7 & 8.

5.4. Priority industrial sectors

5.4.1 Aerospace

Aerospace manufacturing is a priority sector because composite components are widely used where weight, strength and performance are critical. Quality requirements are stringent, component values can be high and process traceability is important.

FLASH-COMP has direct relevance through the IAI wing-box use case, in which project technologies were applied to a full-scale aerospace-related demonstrator using materials and process conditions defined with reference to IAI's manufacturing requirements. **[Project evidence: RP3 Scientific Report, WP6]**

This direct validation makes aerospace a defensible initial application sector. However, commercial deployment will require consideration of qualification, repeatability, process-control requirements and integration with established aerospace production and quality systems.

5.4.2 Marine

Large composite components are used extensively in yacht and marine manufacturing. LRI is relevant to the manufacture of large structures, where material use, infusion consistency and the cost of rework or failure can be significant.

FLASH-COMP's industrial work with AZIMUT provides a direct connection to this sector, including the use of industrial trial data to exercise the digital testbed and DSS chain. **[Project evidence: RP3 Scientific Report, WP5]**

Further evidence from AZIMUT's completed questionnaire and final technical reporting will be required to quantify the industrial benefit and identify the most appropriate users, decision-makers and adoption pathway.

5.4.3 Automotive

Automotive manufacturers and suppliers use composite materials in selected structural, performance and lightweighting applications. High production volumes make cycle time, repeatability, automation and cost particularly important.

Automotive was not one of the two FLASH-COMP industrial validation cases. It should therefore be presented as a potential transfer market rather than a sector in which the complete solution has already been demonstrated.

5.4.4 Wind energy

Wind-turbine blades and other large structures use composite materials and require consistent manufacturing across large geometries. Monitoring resin flow, process conditions and material behaviour may therefore be relevant.

As with automotive, further work would be required to validate the applicability of specific FLASH-COMP components to the materials, geometries, production rates and quality requirements of the sector.



5.4.5 Other composite manufacturing sectors

Possible additional applications may exist in rail, construction, energy, defence, sporting goods and other sectors using infused or large composite structures. These should not be treated as established target markets without evidence from the partner questionnaires, customer interviews or further sector research.

The immediate market analysis should prioritise aerospace and marine because these are supported by project use cases, then assess other sectors according to technical fit, addressable need, ease of entry and partner capability.

5.5. Customer and user groups

The buyer, user and beneficiary of a FLASH-COMP result may not be the same organisation or individual. Exploitation planning should distinguish between those who purchase a solution, those who approve its installation, those who integrate it and those who use the outputs.

Potential customer and stakeholder groups include:

- Manufacturers of composite components;
- Aerospace, marine, automotive and wind-energy original-equipment manufacturers;
- Tier suppliers and specialist composite manufacturers;
- Sensor, inspection and machine-vision providers;
- Industrial automation and systems-integration companies;
- Manufacturing-software and data-platform providers;
- Simulation and engineering-software companies;
- Research and technology organisations;
- Engineering and sustainability consultancies;
- Vocational-training providers and higher-education institutions;
- Regional Digital Innovation Hubs and industrial clusters;
- Organisations funding industrial validation and technology adoption.

Within manufacturing organisations, relevant decision-makers may include production directors, plant managers, quality managers, process engineers, digitalisation leaders, automation managers, sustainability managers and research or innovation teams.

5.6. Market drivers and opportunities

Cost quality and waste reduction

The central value proposition for ZDM is the avoidance of defects, scrap and rework. For large or high-value composite components, preventing one failed manufacturing cycle may avoid substantial material, labour and production-time losses.

This proposition must be quantified for each KER and customer type. General statements that a result “reduces cost” or “improves efficiency” will not be sufficient. Evidence should include the cost of a failed component, present defect or rework rates, production-cycle duration, inspection costs and the proportion of failures that the proposed technology could realistically prevent.



Demand for production visibility

The move towards connected manufacturing creates demand for more timely information on process performance. The gap between the availability of production data and the ability to translate it into useful decisions provides an opportunity for platforms and DSS technologies.

Sustainability and resource efficiency

Defect prevention can support sustainability by reducing wasted raw materials, energy consumption and reprocessing. The environmental benefit will depend on the manufacturing process, component, avoided failure and additional equipment required.

Digital transformation

European programmes and industrial strategies continue to support digitalisation, advanced manufacturing, data use and AI adoption. This creates opportunities for further validation, demonstration and deployment of the FLASH-COMP results.

Skills and human centred adoption

The introduction of monitoring, simulation and AI-supported decision-making changes the information available to workers and may require new competencies. The FLASH-COMP skills analysis and training work provide a basis for supporting this transition. **[Project evidence: WP5 skills-gap work and training outputs]**

5.7. Barriers to adoption

Integration with existing systems

Manufacturers may already use production-management, quality, sensor or data systems. A new platform or DSS must therefore connect with existing equipment and software without causing unacceptable disruption or creating isolated data structures.

This strengthens the case for modular solutions, standard communication methods and collaboration with systems integrators.

Installation and configuration

Monitoring performance may depend on component geometry, materials, lighting, sensor position, calibration and process configuration. The FLASH-COMP validation work identified these factors as important to measurement quality and repeatability. **[Project evidence: RP3 Scientific Report, WP6 lessons learned]**

Commercial offerings will need to define what can be standardised and what must be configured for each customer.

Data availability and quality

AI, defect-estimation and predictive tools require appropriate data. Industrial datasets may be limited, commercially sensitive, inconsistent or insufficiently labelled. Data-sharing restrictions can also affect collaborative model development.



Industrial validation and trust

Potential users will require evidence that recommendations and alerts are reliable in their production environment. False alarms missed events or poorly explained outputs may reduce operator confidence.

Demonstrators and testbeds can address this barrier by providing evidence and allowing users to observe the system before full deployment. Customer interviews should investigate the level of validation required by different sectors.

Skills and organisational readiness

Successful implementation may require changes to roles, procedures, training and decision-making. The technology may be technically effective but fail to deliver value if staff do not understand or trust it or if responsibilities for acting on the information are unclear.

The ZDM Maturity Model and training resources address this aspect of adoption, as evidenced in WP6.

Cost and return on investment

Even where technical benefits are recognised, adoption may be constrained by capital cost, integration effort, ongoing support requirements and uncertainty about return on investment.

The business plans must therefore compare implementation cost with the value of avoided failures, reduced inspection, improved productivity or additional process capability. **See chapters 7 & 8.**

Standards regulation and cybersecurity

Data platforms, connected equipment and AI-supported systems may be subject to requirements relating to cybersecurity, data governance, safety, quality management or AI use. The relevance of these requirements will depend on the product configuration, intended use and sector.

5.8. Competitive and alternative solutions

The competitive environment includes more than products that closely replicate the complete FLASH-COMP concept. Potential customers can address the same underlying problem in several ways.

Conventional inspection

A manufacturer may continue to rely on visual inspection, non-destructive testing or quality checks after manufacture. These approaches may be well understood and already incorporated into approved procedures. FLASH-COMP-related offerings must demonstrate what additional value is created by earlier monitoring or decision support.

Standalone monitoring technologies

Sensor, machine-vision, hyperspectral, LiDAR and fibre-optic providers may offer systems capable of addressing part of the monitoring requirement. The FLASH-COMP proposition must distinguish between supplying a device and providing an LRI-specific monitoring and interpretation capability.



Industrial platforms

Large automation and software providers offer industrial IoT, manufacturing-data, analytics and digital-twin platforms. These providers may be competitors, technology suppliers or potential integration partners.

The existing market research identifies companies such as Siemens, Dassault Systèmes and Cognex as relevant examples, but company-specific comparisons should use official product information and should assess functionality rather than relying on broad statements about market leadership.

Engineering and integration services

Manufacturers may commission a systems integrator or engineering consultancy to develop a bespoke solution using existing technologies. This may compete with a packaged FLASH-COMP offering but may also provide a route through which project results reach the market.

Internal development

Large manufacturers may develop their own monitoring, simulation or data-analysis capabilities. The commercial proposition must therefore explain why buying, licensing or collaborating with a FLASH-COMP partner is faster, less risky or more cost-effective than internal development.

5.9. Policy standards and funding environment

European industrial and digital policy

FLASH-COMP aligns broadly with European priorities concerning industrial digitalisation, advanced manufacturing, sustainability, AI and resilient supply chains. Final statements should be linked to current official European Commission strategies rather than relying on general policy language.

Circular economy and resource efficiency

The potential reduction of scrap and rework connects the project with European resource-efficiency and circular-economy objectives. However, the relationship should be presented proportionately: FLASH-COMP contributes through process improvement and defect prevention but does not by itself establish circularity across the complete composite lifecycle.

Standards

The FLASH-COMP Standardisation Roadmap reviewed relevant standards and potential gaps. The project concluded that no sufficiently significant gap in composite manufacturing had been identified to justify developing a new standard within the project. **[Project evidence: Standardisation Roadmap (D8.2) and UR description]**

The existing market document also refers to CEN-CENELEC work on ZDM terminology. The exact workshop agreement, status and relevance should be confirmed from the original CEN-CENELEC source.

Public funding and investment

Further development may be supported through European, national or regional programmes concerned with advanced manufacturing, industrial AI, digitalisation, sustainability or skills. Potential



routes identified in the existing research include Horizon Europe, Digital Europe, regional innovation funding and national industrial programmes.

Funding opportunities change over time. The final document should describe relevant funding categories and current programmes without presenting an expired or unsuitable call as an available route.

Private investment may be relevant for results with a sufficiently defined product, market, team and growth opportunity. For other results, collaborative R&D, contract research or strategic industrial partnerships may be more realistic than venture investment. The appropriate route has been assessed through the partner questionnaires.

5.10. Implications for FLASH-COMP

The market landscape suggests several principles for the exploitation strategy.

Prioritise markets supported by project evidence

Aerospace and marine provide the strongest initial sector narratives because FLASH-COMP has worked directly with IAI and AZIMUT. Other sectors should be treated as transfer opportunities requiring additional validation.

Maintain a modular proposition

Potential users have different existing equipment, data infrastructure and process needs. A configurable offering is likely to be more credible than assuming that every customer will adopt every FLASH-COMP component. This modularity supports two market strategies: MSI can replicate the generic Data Platform across sectors, while the jointly owned Combined DSS can initially focus on composite manufacturing under the proposed exploitation leadership of INEGI.

Work with integrators and established providers

The technical partners may not wish to deliver every element of a complete industrial installation. Equipment suppliers, systems integrators and engineering companies may provide important routes to market.

Use the testbeds and demonstrators as evidence

Industrial adoption will depend on credibility and validation. The INEGI testbed and industrial demonstrators can support technical demonstrations, customer discussions, training and further trials.

Quantify customer value

The strongest business case will be based on avoided failures, reduced rework, improved production visibility or better use of equipment and personnel. These benefits must be calculated using credible industrial data rather than generic market statements.

Combine commercial and research led routes

Some results may move towards direct commercial exploitation, while others will progress through collaborative projects, contract research or further industrial validation. These routes can operate in parallel across the portfolio.



Address adoption as an organisational process

Training, operator involvement and organisational readiness are part of implementation rather than secondary communication activities. The technical and human-centred results should therefore be presented together when engaging potential industrial users.

6. INTEGRATED EXPLOITATION OPPORTUNITIES

6.1. Purpose and evidence status

The FLASH-COMP portfolio contains technologies that can potentially be used independently as well as components that may create greater value when combined. This chapter examines the principal integrated exploitation opportunities emerging from the project and the conditions required to take them forward.

The purpose is not to present these combinations as finished commercial products or as formal joint ventures already agreed by the partners. It is to identify where technical integration has been demonstrated, where the consortium has recognised a possible combined exploitation route and what commercial, legal and operational matters remain to be agreed.

The opportunities are described using three evidence levels.

Table 3. Evidence levels adopted to reflect the progress achieved by FLASH-COMP while avoiding assumptions about the intentions or commitments of individual partners

Evidence level	Meaning
Demonstrated	Components or data flows that were integrated, exercised or validated through FLASH-COMP technical activity
Proposed	A future exploitation opportunity identified or discussed by the consortium but not yet established as a formal commercial offering
To be agreed	Ownership, access, business-model, resource or responsibility matters requiring confirmation through partner questionnaires and subsequent agreement

6.2. Integrated Decision Support System

6.2.1 Opportunity

The most clearly defined integrated exploitation opportunity is the Combined Decision Support System jointly developed through MSI, INEGI and LORTEK.

MSI's Data Platform provides the generic architecture for receiving, processing, storing and exchanging information. Process-specific data, data models and algorithms are added alongside INEGI's simulation capability, LORTEK's analytical contributions, DSS rules, HMI and decision-support functionality. Together, these elements transform manufacturing and monitoring data into contextual information that supports operator understanding and action.

The integrated opportunity can be represented as:

Process and monitoring data → MSI generic Data Platform → process-specific data models, simulation and AI analysis → DSS rules and decision-support functions → HMI and operator action

The resulting proposition is broader than any component individually. The generic Data Platform manages and exchanges information, while process-specific models, simulation and AI interpret



expected and observed behaviour. The DSS and HMI combine these capabilities and present relevant information to the operator.

6.2.2 Demonstrated basis

FLASH-COMP has demonstrated the principal technical foundations of this opportunity through the digital testbed.

The project integrated:

- Sensor, camera and simulation data received through MQTT;
- Data processing and normalisation through Node-RED;
- Data storage using databases selected according to information type;
- The MSI Data Platform ;
- Server-side DSS rules;
- Standardised alerts;
- Real-time communication with an operator-facing web application;
- Campaign-based storage and historical replay;
- Separate real-time, replay and training or simulation modes.

The complete digital chain was exercised using data from the AZIMUT industrial trials. The architecture demonstrated a route from heterogeneous data inputs to operator-oriented DSS information.

This work supports the technical feasibility of combining data-platform, simulation and decision-support functions. It does not by itself establish the commercial terms under which the components will be offered after the project.

6.2.3 Proposed exploitation opportunity

The portfolio records the generic Data Platform, Simulation Tool and relevant analytical capabilities as independently exploitable results. Their integration with process-specific data, models, algorithms, DSS functionality and HMI create the separately owned Combined DSS. Ownership is shared between MSI, INEGI and LORTEK. INEGI is the proposed main exploiter for composite manufacturing, subject to agreement on ownership shares, partner responsibilities and MADE's role.

A combined DSS could be configured according to the requirements of an industrial customer. Possible configurations include:

- The Data Platform and Simulation Tool connected to monitoring equipment already used by the customer;
- An integrated package incorporating selected FLASH-COMP monitoring technologies;
- A deployment using the Data platform primarily for process visibility, with simulation added where predictive or decision-support capability is required;
- A customised implementation for a particular material, component geometry or production process;
- A demonstration or research installation intended to generate evidence before wider deployment.

The system should not be presented as requiring every FLASH-COMP component. Its modularity is important to the value proposition because potential customers will have different infrastructure, data sources and operational needs.



6.2.4 Matters to be agreed

Shared ownership by MSI, INEGI and LORTEK has been confirmed in principle. Before the Combined DSS becomes a formal commercial offering, the partners must still agree:

- The precise ownership shares, including whether ownership will be divided equally;
- Access to background and foreground intellectual property;
- Formal confirmation of INEGI's proposed role as main exploiter and ownership of the customer relationship;
- MSI's, INEGI's and LORTEK's technology-provider, configuration and integration responsibilities;
- Responsibility for simulation configuration and model validation;
- Hosting and deployment arrangements;
- Software maintenance and version management;
- Customer support and service-level responsibilities;
- Cost, price and revenue-sharing arrangements;
- Treatment of customer data;
- Liability for alerts, recommendations and system performance;
- Branding and marketing, together with MADE's continuing role, if any;
- The procedure if one partner does not wish to participate in a particular deployment.

The completed KER questionnaires will provide the initial evidence for these decisions. A separate bilateral exploitation or collaboration agreement may then be required if the partners decide to proceed.

6.3. Integrated inspection and monitoring solution

6.3.1 Opportunity

The second principal integrated opportunity combines selected inspection and monitoring technologies with the software, processing methods and algorithms required to apply them to LRI composite manufacturing.

The potential technical components include:

- Matrix and multispectral cameras;
- Hyperspectral imaging;
- LiDAR and three-dimensional profiling;
- Fibre Bragg Grating sensors;
- All Grating Fibre sensors;
- Printed Pyzoflex sensors;
- Associated data-extraction, signal-processing and interpretation tools.

The commercial value does not lie solely in grouping several devices together. It lies in selecting, configuring and integrating an appropriate combination of technologies for a defined manufacturing problem.

6.3.2 Demonstrated basis

FLASH-COMP tested and applied different monitoring technologies through its testbed and industrial validation activity.

The demonstrated work included:



- Testing FOS technologies under different process conditions;
- Monitoring vacuum, resin arrival, resin-flow progression and curing-related behaviour;
- Scaling sensor configurations to a full-size wing-box demonstrator;
- Generating and preparing FOS data and metadata for transmission to the digital platform;
- Using a matrix camera to record resin-impregnation behaviour;
- Extracting geometric data through three-dimensional profiling;
- Investigating LiDAR and other optical monitoring approaches;
- Integrating heterogeneous monitoring data into the wider digital architecture.

This activity demonstrated that the technologies can provide complementary information. It also identified practical constraints including equipment positioning, lighting, reflections, surface conditions, spatial calibration, handling, repeatability and operator training.

6.3.3 Proposed exploitation opportunity

A combined monitoring solution could be configured around the requirements of a customer rather than offered as a single fixed equipment list. For example:

- An application requiring flow-front monitoring might use cameras or fibre-optic sensing;
- A complex large geometry might require LiDAR or profiling;
- Monitoring within or close to the laminate might favour embedded or surface-mounted sensors;
- A chemical or cure-related application might require spectral imaging;
- A high-value manufacturing process might justify several complementary monitoring modes.

The package could include:

- Selected hardware;
- Mounting and positioning design;
- Acquisition software;
- Data-processing algorithms;
- Calibration procedures;
- Connection to a customer's existing systems;
- Connection to the FLASH-COMP Data Platform or DSS;
- Installation, training and support.

This approach allows the individual tools to retain standalone exploitation potential while creating a system-level offering when several are required.

6.3.4 Potential role of a systems integrator

A specialist systems integrator may provide an effective route to market for the combined monitoring solution. The integrator could manage customer requirements, equipment procurement, installation, connectivity, testing and ongoing support while licensing or subcontracting specialist technology from the relevant FLASH-COMP partners.

This model may reduce the need for every technology-owning partner to develop a complete sales and support capability. It may also provide customers with one accountable delivery organisation.

However, an integrator would require clear technical documentation, interfaces, licensing terms, performance responsibilities and access to specialist support. The partners would also need to determine whether integration should be led by a consortium member or by an external commercial organisation.



6.3.5 Matters to be agreed

The combined monitoring opportunity requires confirmation of:

- Which technologies are intended for inclusion in future joint offers;
- Who owns each hardware adaptation, algorithm and software component;
- Whether each responsible partner is willing and able to support commercial deployments;
- How equipment will be sourced;
- Who will design and certify the integrated configuration;
- Responsibility for installation, calibration and validation;
- Warranty and liability arrangements;
- Maintenance, replacement and software-update responsibilities;
- Licensing or subcontracting terms;
- Whether an external integrator should lead delivery;
- How revenue and customer-support costs would be allocated.

The partner questionnaires determined whether the combined solution is a realistic, planned route or should remain a possible configuration assembled on a project-by-project basis.

6.4. Wider modular FLASH-COMP system

6.4.1 System opportunity

The integrated DSS and monitoring package can be connected within a wider modular system:

Inspection and monitoring → data platform and processing → simulation and defect estimation → decision support → operator information and action

This represents the most complete expression of the FLASH-COMP technical concept. It connects the physical process with digital analysis and operator support.

The wider system may draw on:

- KER 1, the Data Platform;
- KER 2, the Simulation Tool;
- KER 3, the combined DSS;
- KER 4, individual inspection and monitoring tools;
- KER 5, the combined monitoring package;
- ER 1, the FLASH-DSET;
- ER 2, Data Augmentation Dynamics.

The physical and digital testbeds and industrial demonstrators provide supporting environments and evidence for the integrated chain.

6.4.2 Configurable rather than fixed

The wider system should be understood as a reference architecture and integration opportunity rather than as one fixed commercial product.

A customer may already possess:

- Suitable cameras or sensors;
- A manufacturing-data platform;
- Simulation software;
- An operator dashboard;



- Quality-management systems;
- Internal data-analysis capability.

In such cases, a FLASH-COMP partner may supply only the missing component, algorithm or integration service. Another customer may require a more extensive solution.

Potential configurations include:

1. **Monitoring only:** Selected sensors or cameras with associated processing.
2. **Monitoring and Data platform:** Process data collected and displayed through the MSI environment.
3. **Simulation only:** INEGI's modelling capability linked to customer data and a third-party interface.
4. **Data Platform and simulation:** The combined DSS using existing customer monitoring.
5. **Full monitoring and DSS:** Selected FLASH-COMP monitoring technologies linked to the platform, simulation and operator interface.
6. **Research configuration:** Testbed deployment for further validation, data generation or technology development.

This modular approach reduces dependence on a single market-entry route and allows partners to respond to different levels of customer readiness.

6.4.3 Evidence status

The end-to-end digital chain and selected monitoring integrations were demonstrated within FLASH-COMP. However, the project documentation does not establish that the complete portfolio has been productised as one commercially supported system.

The wider system should therefore be described as an integration and collaboration opportunity. Claims about performance, price, installation time, support or readiness for sale are based on the final technical evidence and completed partner questionnaires (Chapter 7)

6.5. Supporting exploitation assets

The technical components are supported by results that can reduce adoption risk, demonstrate value and prepare users for implementation.

6.5.1 INEGI testbed

The INEGI testbed can support:

- Further integration testing;
- Customer demonstrations;
- Proof-of-concept activity;
- Generation of process data;
- Comparison of monitoring configurations;
- Simulation and DSS testing;
- Industrial and researcher training;
- Future collaborative projects.

Its role is particularly valuable where a potential customer requires evidence before allowing technology to be installed within a production environment.

- [See the documentary film made about the testbed demonstration at INEGI in Porto here](#)



6.5.2 Industrial demonstrators

The AZIMUT and IAI demonstrators provide industrially relevant evidence and practical learning. They can be used to:

- Explain how project technologies were applied;
- Demonstrate the feasibility of monitoring large composite processes;
- Illustrate data generation and integration;
- Support discussions with potential customers and collaborators;
- Provide evidence for future research and funding proposals;
- Showcase the industrial partners' advanced-manufacturing and sustainability activity.

The demonstrators support the integrated proposition but are not products that must accompany a future deployment.

- [See industrial demonstration film made at AZIMUT and showcasing the pre-infusion, infusion and post-infusion stages of FLASH-COMP technologies tested at industrial scale](#)

6.5.3 Manufacturing Sustainability Assessment Methodology

POLIMI's methodology can help a prospective user assess its readiness for ZDM and digitalisation. This can identify gaps in processes, platforms, skills and organisational capability before a technical solution is selected or installed.

The methodology could therefore support an integrated exploitation pathway:

1. assess the customer's maturity and needs;
2. identify the required monitoring and digital capabilities;
3. define a suitable configuration;
4. plan implementation and skills development;
5. assess progress and benefits.

This service-led approach may be particularly relevant for organisations that understand the need for digital transformation but have not yet defined a technical specification.

6.5.4 Training and skills development

ESTIA's training modules and the project's skills analysis can support implementation by preparing operators, engineers and students to understand the relevant technologies and their effect on working practices.

Training can be delivered as:

- Part of a system implementation;
- A standalone workforce-development activity;
- Material within existing education programmes;
- Support for demonstrations and testbed activity;
- A contribution to future collaborative projects.

Training should be considered part of the adoption pathway rather than an optional dissemination activity.

6.6. Standalone and joint exploitation models

The portfolio supports several exploitation models. The most appropriate model may differ by result, customer and application.



Separate partner exploitation

Each partner commercialises or uses its own result independently. Other FLASH-COMP components may be referenced as compatible options but are not part of the transaction.

This model offers clear responsibility but may provide the customer with only part of the wider solution.

Bilateral offering

Two partners may combine complementary results for a specific opportunity. However, the Combined DSS is now understood as a multi-partner result involving MSI, INEGI and LORTEK rather than solely an MSI–INEGI bilateral offer.

A bilateral model may still be appropriate for other combinations, but it does not describe ownership of the Combined DSS.

Multi partner delivery

Several partners jointly provide monitoring, data, simulation and decision-support components. The Combined DSS is the principal example: INEGI is the proposed main exploiter, with MSI and LORTEK contributing the technologies and specialist capabilities required for the agreed configuration.

This offers the most complete technical proposition but requires stronger coordination, commercial governance and contractual clarity.

Licensing to an integrator

Partners license software, algorithms or specialist knowledge to an organisation capable of delivering and supporting the full installation.

This may provide access to established customers and delivery infrastructure but may reduce the partners' control over pricing, branding and the customer relationship.

Customer specific engineering

A customer contracts one or more partners to design a configuration for a specific production line or component.

This service-led route can generate early revenue and evidence but may produce bespoke implementations that are difficult to scale unless common modules and procedures are retained.

Collaborative research and demonstration

The partners continue development through European, national, regional or customer-funded research projects.

This is appropriate where further validation, data generation or TRL advancement is required. It should include a clear plan for how the additional research will move the result closer to sustained use.

6.7. Conditions for joint exploitation

Technical compatibility is necessary but not sufficient for joint exploitation. Before partners make a combined offer, they should agree the following matters.



Ownership and access

- Ownership of each component;
- Ownership of new integration work;
- Access to relevant background intellectual property;
- Rights to modify, sublicense or support the components;
- Restrictions arising from third-party technology.

Commercial leadership

- Lead organisation for the opportunity;
- Ownership of the customer relationship;
- Responsibility for proposals, negotiation and contracting;
- Use of joint or individual branding;
- Management of sales leads generated through FLASH-COMP activity.

Technical delivery

- System design authority;
- Interface specifications;
- Component configuration;
- Integration and acceptance testing;
- Documentation;
- Deployment and commissioning;
- Management of software versions and updates.

Financial arrangements

- Pricing model;
- Allocation of proposal and integration costs;
- Revenue-sharing or subcontracting arrangements;
- Payment terms;
- Funding of productisation and maintenance;
- Treatment of unsuccessful bids or unpaid preparatory work.

Support and liability

- First-line and specialist customer support;
- Service levels and response times;
- Warranty responsibilities;
- Responsibility for incorrect data, missed events or false alerts;
- Limits of liability;
- Cybersecurity and data-protection obligations.

Continuity

- Arrangements if a partner withdraws;
- Rights to appoint an alternative supplier or integrator;
- Continued access to software and documentation;
- Maintenance of customer installations;
- Treatment of jointly developed improvements.



These conditions should be scaled to the opportunity. A research demonstration will not require the same commercial structure as a supported production deployment, but roles and rights should still be clear.

6.8. Development and validation priorities

Several cross-cutting priorities must be addressed before the integrated opportunities can progress towards repeatable deployment.

Productisation

Research components must be converted into documented and maintainable modules. This includes stable interfaces, installation procedures, configuration controls, user documentation and version management.

Repeatable deployment

The partners need to distinguish between customer-specific engineering and reusable components. Repeatable deployment will require defined hardware configurations, calibration methods, data structures and acceptance procedures.

Integration testing

Combined configurations should be tested as systems, not only as separate technologies. This should include data integrity, timing, alert handling, failure modes, replay isolation and interface behaviour.

Additional industrial validation

Further validation may be needed across different materials, component geometries, tooling arrangements and production environments. The required evidence will vary by sector and customer.

Monitoring robustness

The project identified challenges associated with lighting, surface reflections, wrinkles, physical obstructions, sensor handling, spatial alignment and equipment repositioning. Mitigations must be incorporated into future deployment procedures and system design.

User interface and decision support

Alerts and recommendations must be relevant, understandable and linked to defined operator actions. Thresholds and rules may require customer-specific validation.

Benefit quantification

The partners will need evidence of:

- Defects or process deviations identified;
- Avoided scrap or rework;
- Time saved;
- Improved process visibility;
- Changes in inspection requirements;
- Implementation and operating costs.

This evidence will support customer decisions and pricing.



Customer and integrator engagement

Potential customers and integration partners should be engaged early to test the proposed configurations, purchasing models and support arrangements.

6.9. Decisions required

The opportunities outlined in this chapter can be further assessed against a common set of questions if responsible partners are to take assets forward.

Combined DSS

- Do MSI, INEGI and LORTEK formally confirm shared ownership and the proposed ownership allocation?
- Does INEGI formally accept the role of main exploiter, and what role will MADE retain?
- What delivery, support, integration and productisation roles will MSI, INEGI and LORTEK perform?
- Who will own the customer relationship and what intellectual-property and access arrangements will apply?
- What resources can each partner commit to delivery, maintenance and customer support?
- What revenue-sharing, liability, commercial model and timescale are realistic?

Combined monitoring solution

- Which technology owners wish to participate?
- Which components are sufficiently mature for external deployment?
- Should delivery be led internally or through an integrator?
- What installation, calibration and support can each partner provide?
- How will the package be configured and priced?
- What further validation is necessary?

Wider modular system

- Is there demand for a complete system or mainly for individual modules?
- Which configurations should be prioritised?
- Who can act as system architect and prime contractor?
- How will customer data and performance responsibility be managed?
- What minimum evidence is required before market engagement?

Supporting services

- Can the testbed be offered as a contract service?
- Can the maturity methodology form a paid consultancy activity?
- Can training be incorporated into implementation packages?
- How will demonstrators be used in customer engagement?
- Which partner will maintain and deliver each supporting asset?

The answers will determine whether each opportunity should progress as:

- An agreed commercial route;
- A development priority;
- A customer-specific option;
- A licensing opportunity;
- A future collaborative-research route;



- Or an opportunity that is not currently supported by the responsible partners.

6.10. Next stage

The integrated opportunities provide a project-level view of how FLASH-COMP results may work together.

The KER business plans show the commercial intentions, markets, ownership, resources, risks and roadmaps for the principal technologies and integrated offerings. The ER action plans define how results requiring further development can progress. The UR strategies explain how knowledge and capability-based outcomes will continue to be used.

7. EXPLOITATION PORTFOLIO EVIDENCE AND CROSS-CUTTING ANALYSIS

Purpose. This chapter consolidates the completed partner questionnaires into a single evidence base for the next stage of FLASH-COMP exploitation planning. It connects the agreed portfolio of KERs, ERs and URs with the result-specific commercial, development and continued-use plans that will follow.

Main conclusion. The project has produced a portfolio of technologies, methods and knowledge assets with different levels of maturity and different exploitation routes. The strongest project-level opportunity is the combination of sensing and monitoring, data management, simulation and defect-estimation capabilities within an integrated decision-support proposition. However, the individual components also retain independent value. The final plans must therefore address both levels: partner-led exploitation of individual results and coordinated exploitation where integration creates additional value.

7.1. Purpose and scope

The exploitation portfolio is not treated as a uniform set of products. Each category requires a different planning approach. KERs need the clearest definition of customer need, competitive value, validation status, ownership, business model and route to market. ERs may support commercial services or become components of wider solutions, but may also need additional integration, validation or funding before a standalone market case is realistic. URs create value principally through continued use, knowledge transfer, skills development, positioning, standardisation and future collaboration.

This chapter uses the questionnaires completed by relevant partners. It records the evidence supplied by these partners, identifies where conclusions remain provisional and sets out the issues that must be resolved before the detailed exploitation plans are finalised. This prevents early assumptions about market potential, ownership or readiness from being presented as agreed facts.

7.2. Evidence base and current coverage

Ten completed questionnaires have been reviewed: four KER forms, four ER forms and two UR forms. Together they provide substantial evidence on technical maturity, validation, potential users, ownership, dependencies, exploitation routes, risks and next-stage requirements. They also reveal several areas where the result register and the returned forms must be reconciled, particularly where a combined portfolio result is represented by separate component-level submissions.



Table 4. Summary of completed FLASH-COMP KER, ER and UR questionnaires

Category	No. forms	Evidence available
KER	4	• Combined DSS, • Data Platform • Hyperspectral imaging monitoring • Fibre-optic sensing
ER	4	• DSET • Data Augmentation Dynamics • POLIMI maturity methodology • AZIMUT demonstrator
UR	2	• Training modules • Standardisation roadmap

7.3. Consolidated exploitation portfolio

The tables below provide a planning-level view of the agreed portfolio. They are not substitutes for the detailed exploitation profiles. Their purpose is to show the relationship between each result, the evidence currently available and the immediate planning implication.

7.3.1 Key Exploitable Results

Table 5 Summary of Key Exploitable Results portfolio

ID	Result	Lead partner	Evidence	Immediate implication	planning
KER1	Combined Decision Support System for liquid resin infusion	INEGI proposed as main exploiter; jointly owned by MSI, INEGI and LORTEK	Returned and supplemented by partner confirmation	Confirm ownership percentages, formalise INEGI's lead role, define partner delivery responsibilities.	
KER2	FLASH-COMP Data Platform	MSI, sole owner and main exploiter	Returned	Position as a generic cross-sector architecture, document an industrial reference deployment and develop replication routes beyond composites.	
KER3	Simulation tool and process-simulation algorithms	INEGI	Partial	Obtain the full result profile covering readiness, ownership and route to market.	



ID	Result	Lead partner	Evidence	Immediate implication	planning
KER4	Inspection monitoring and tools adapted for LRI	LORTEK, AIMEN and contributors	Component evidence	Reconcile HSI and FOS components with the agreed portfolio result.	
KER5	Integrated hardware-software monitoring solution	Technology owners; lead to confirm	Partial	Define the package boundary, commercial lead, interfaces and ownership.	

7.3.2 Exploitable Results

Table 6 Summary of Exploitable Results portfolio

ID	Result	Lead partner	Evidence	Immediate implication	planning
ER1	AI-based Defect Estimation Tool or DSET	LORTEK	Returned	Complete industrial validation and define the host solution and exploitation lead.	
ER2	Data Dynamics Augmentation	MSI, sole owner and main exploiter	Returned	Demonstrate measurable gains in AI, simulation or validation applications and document source-dataset rights for each deployment.	
ER3	INEGI testbed	INEGI	Partial	Detail its research, validation, training and industry-engagement operating model.	
ER4	Industrial demonstrators	AZIMUT and IAI	Partial	Complete trials, capture KPIs and add IAI continued-use and exploitation evidence.	
ER5	Manufacturing sustainability and ZDM maturity methodology	POLIMI	Returned	Validate with a wider industrial panel and define a repeatable assessment offer.	



7.3.3 Usable Results

Table 7. Summary of Usable Results portfolio

ID	Result	Lead partner	Evidence	Immediate implication	planning
UR1	Training modules and learning materials	ESTIA	Returned	Finalise, host and maintain the materials and record their reuse.	
UR2	Standardisation roadmap	LORTEK and MADE; custodian to confirm	Returned	Assign ownership and convert priorities into actions linked to the KER roadmaps.	
UR3	Scientific publications	Contributing research partners	Returned	Compile the publication register and document reuse, audiences and follow-on activity.	

7.4. Relationship between the individual results

The questionnaires confirm that the portfolio contains both standalone results and interdependent components. MSI's Data Platform is a generic architecture for industrial data acquisition, harmonisation, storage and exchange and excludes process-specific data and models. INEGI's simulation capability, LORTEK's analytical and AI contributions, DSET and Data Augmentation Dynamics provide application-specific functions. The jointly owned Combined DSS brings selected elements together with DSS rules, HMI and decision-support functionality to provide stage-aware guidance for operators.

This creates a layered exploitation architecture:

Sensing and monitoring layer: adapted cameras, hyperspectral imaging, fibre-optic sensing and other process sensors generate information about the infusion and curing process.

Data and interoperability layer: MSI's generic Data Platform provides the reusable digital architecture, while customer and process-specific data remain separate application assets.

Process-specific analysis and prediction layer: industrial data, data models, INEGI's simulation capability, LORTEK's analytical functions, DSET and MSI's synthetic-data environment support process interpretation and validation.

Decision-support and HMI layer: the jointly owned Combined DSS presents rules, predictions and process-stage information in a form that supports operator decisions.

Validation and adoption layer: the INEGI testbed and the AZIMUT and IAI demonstrators provide environments for technical validation, training, internal adoption and market-facing evidence.



The integrated proposition may create the greatest combined value, but it should not replace the component-level plans. Some partners may license technology, deliver integration or assessment services, use results internally, or apply them in future projects. The exploitation framework must allow these routes to coexist and must state which interfaces, data and rights are needed when results are combined.

7.5. Cross-cutting findings

7.5.1 Industrial validation is the common development gate

The DSS, HSI, FOS, DSET, Data Platform and demonstrator questionnaires all identify a need for further real-environment evidence. The next stage should therefore be organised around a coordinated validation programme rather than separate, unconnected tests. Common baselines and KPIs should measure defect avoidance, scrap, cycle time, labour, energy use, integration effort and operator usability. This would generate the evidence needed for both technical progression and credible business cases.

7.5.2 Market readiness differs substantially between results

The portfolio ranges from enabling algorithms at approximately TRL 4-5 to integrated prototypes at TRL 6. Some results could enter paid pilot or integration activity relatively soon, while others need additional R&D, lower-cost hardware, certification or broader datasets. The detailed plans should therefore use result-specific roadmaps and distinguish technical validation, productisation, market entry and longer-term replication.

7.5.3 Commercial benefit claims require stronger evidence

Most questionnaires do not yet provide measured customer benefits. Where savings, market growth or deployment-cost figures are included, they are often estimates, experience-based assumptions or unsupported by an identifiable source. These figures can guide planning but should not be used as final external claims until the source, baseline, scope and applicability have been confirmed.

7.5.4 Service and licensing models are more prominent than direct product sales

The Data Platform is expected to support MSI-led integration projects, licences, maintenance and cross-sector replication. The Combined DSS is expected to follow an INEGI-led pilot and integration route, supported by MSI and LORTEK as technology providers. AIMEN proposes licensing the FOS system to a specialist integrator, while the POLIMI methodology may be delivered as an assessment service. Business planning should therefore address delivery capability, partner channels, support obligations, maintenance and licensing terms, as well as conventional product pricing.

7.5.5 Joint exploitation governance is not yet mature

Several results depend on technology or data owned by other partners. Shared ownership of the Combined DSS between MSI, INEGI and LORTEK is now confirmed in principle. However, the precise ownership percentages, exploitation leadership, revenue allocation, access rights, delivery responsibilities and support model have not yet been formalised. INEGI is the proposed main exploiter, while MADE's role remains to be checked. Similar questions remain for shared frontends, partner datasets and the system-level monitoring package.

7.5.6 Data access is both an asset and a constraint

Ownership of the Data Platform and Data Augmentation Dynamics is confirmed as MSI, 100%. Individual deployments of the Data Platform, Data Augmentation Dynamics, DSET, simulation and



Combined DSS may nevertheless depend on customer or partner datasets. The plans must specify who owns those data, how they can be retained and reused, whether they can train or validate later models, how confidentiality is protected and what access remains after the project.

7.5.7 External market evidence remains limited

Few questionnaires report external customer trials, expressions of interest or validated willingness to pay. The existing market-landscape work can establish the wider context, but result-level plans will require targeted interviews, pilot commitments, competitor comparisons and pricing feedback. Partner expectations should be labelled as hypotheses until this evidence is obtained.

7.5.8 Initial sector focus should follow project evidence and partner access

Marine and aerospace appear most consistently across the questionnaires and project validation activity. Wind, automotive and rail offer plausible extension opportunities but are less strongly evidenced at present. Each commercial result should identify a beachhead sector where the consortium has access, technical proof and a clear problem to solve, with other sectors treated as later replication routes.

7.5.9 URs need stewardship and use plans rather than conventional business plans

The training modules and standardisation roadmap have value through skills, alignment, credibility, future proposals and collaboration. Their plans should name the custodian, intended users, hosting and update arrangements, and the indicators that will demonstrate continued use. Scientific publications should be treated similarly through a consolidated register of outputs, audiences, reuse and follow-on research.

7.5.10 Follow-on collaboration and funding are essential

Several partners identify further R&D, industrial validation, certification, specialist integration or external funding as prerequisites. The final deliverable should therefore include a 12, 24 and 36-month opportunity pipeline covering industrial pilots, targeted funding calls, licensing discussions, validation partners and decision gates for each result.

7.6. Commercial and financial evidence status

The completed questionnaires and supporting project material identify credible business-model options for several FLASH-COMP results. They provide information on potential customers, routes to market, revenue mechanisms, cost drivers and indicative timescales. However, the amount of supporting financial evidence varies considerably between results, making realistic financial projections difficult.

At this stage, however, the available information is sufficient to define potential commercial models and identify the evidence required for further decisions. With limited exceptions, it is not sufficient to support firm product valuations, revenue forecasts, profitability estimates or investment cases. This distinction is important because the technical potential of a result does not automatically establish its commercial value.

The figures and commercial assumptions recorded below should, therefore, be treated as planning evidence. They should not be presented as confirmed prices, savings or sales forecasts unless they are subsequently supported by industrial deployment data, customer engagement or formal commercial decisions by the responsible partner.



7.6.1 Identified business models and revenue streams

The available information indicates that service, integration and licensing models are more immediately applicable to the FLASH-COMP portfolio than direct sales of standardised products. This reflects the maturity of the results and the need to configure several technologies for particular manufacturing processes, equipment and customer environments.

Table 8. Summary of identified business models for each result

Result	Potential business model and revenue streams	Current evidence status
Combined Decision Support System	Paid industrial pilots; process-specific configuration and systems integration; consultancy; operator training; maintenance and support; potentially a packaged or licensed joint offer at a later stage.	Commercial route identified, but pilot pricing, implementation costs, support charges, customer benefits and partner revenue allocation have not been confirmed.
MSI Data Platform	Industrial integration projects; annual software licences; customer-specific configuration; maintenance and technical-support contracts; integration within the Combined DSS; replication in other industrial sectors.	Strongest available commercial evidence. The MSI questionnaire indicates typical deployment values of €30,000–€60,000 and an estimated 30–50% reduction in integration engineering effort compared with bespoke implementations. These figures require substantiation before external use.
INEGI Simulation Tool	Engineering simulation and analysis services; customised industrial implementation; licensing as a software component; incorporation into the Combined DSS or another third-party platform.	Potential models identified; delivery costs, pricing and demand evidence remain to be established.
Hyperspectral Imaging Curing Monitoring	Customer-funded collaborative development; specialist monitoring and analysis services; subsequent licensing or subscription-based access to software or analytical capabilities; inclusion within a wider monitoring or DSS package.	The present hyperspectral camera is indicated at approximately €40,000. Hardware cost is recognised as a barrier. Commercial pricing, licence terms and recurring-revenue levels have yet to be established.
FLASH FOS Monitoring System	Licensing or technology transfer to a specialist FOS integrator; potential product-plus-software offer; software or data-as-a-service provision by a future licensee; inclusion within the Combined DSS.	Preferred licensing route and principal cost drivers are identified, but no licence fee, royalty, product price or revenue forecast is available. The downstream model would depend partly on the selected licensee.



Defect Estimation Tool DSET	Integration into another partner's platform, DSS or service; funded industrial pilot; further development through collaborative research.	Limited standalone commercial value has been identified. No independent pricing or revenue model is currently supported.
Data Augmentation Dynamics	Incorporation into MSI-led AI, simulation, digitalisation and validation projects; potential licence or specialist service contribution; use within selected DSS developments.	Commercial value is expected to be recovered through wider MSI projects and services. No separate price or revenue contribution has been defined.
INEGI Testbed	Paid testing and validation; industrial demonstrations; training; contract research; access as part of collaborative projects.	Potential service routes are identified, but operating costs, available capacity, access terms, cost-recovery requirements and service prices remain to be established.
Industrial Demonstrators	Support for customer engagement, internal adoption, marketing, business development and new collaborative projects.	Value is primarily indirect. There is no evidence supporting treatment of the demonstrators as products for sale.
Manufacturing Sustainability and ZDM Maturity Methodology	Assessment and advisory services; consultancy; application in externally funded research and industrial projects.	A credible service route exists, but delivery effort, service scope, price and repeatability across sectors require further definition and validation.
Training Modules and Learning Materials	Continued use in teaching and industrial training; adaptation within partners' existing education and skills activities; possible support for wider training or consultancy services.	Primarily a continued-use result rather than a direct revenue-generating product. Materials are intended to be openly accessible, subject to the applicable licence conditions. Already being used in Italy.
Standardisation Roadmap	Support for KER development, consultancy, future proposals, internal procedures and engagement with standards activities.	Strategic and enabling value rather than a direct revenue stream.
Scientific Publications	Research reuse, partner positioning, future proposals, collaboration, teaching and wider editorial communication through Insight Media, Projects Magazine and the 4ZDM cluster.	Value is primarily scientific, reputational and collaborative. Direct commercial income is not the principal measure of exploitation.

7.6.2 Available evidence of commercial value

The principal commercial value expected from the FLASH-COMP technologies arises from improved process visibility, earlier identification of abnormal conditions, reduced defects and rework, lower material and energy waste, shorter or more predictable process times, and reduced effort when integrating industrial data and digital applications.



Only a limited proportion of these benefits has been quantified:

- MSI estimates that reuse of its Data Platform architecture could reduce data-integration engineering effort by approximately 30–50% compared with bespoke implementations. Typical deployment projects are estimated at €30,000–€60,000, depending on their scope and complexity.
- LORTEK identifies a present hyperspectral camera cost of approximately €40,000. Reducing this hardware cost is a significant requirement for commercialisation. Potential reductions in mould time, defects and energy use have been identified, but they have not yet been translated into a validated customer saving.
- The Combined DSS is expected to create value principally through avoided scrap and rework, improved operator decisions, reduced post-process inspection and lower resin or material waste. Consolidated figures have not been produced from the industrial demonstrations.
- AIMEN identifies potential savings in materials, finishing, repair and energy through the FOS system. The questionnaire refers to project KPIs intended to validate these benefits, but final monetary values are not currently available.
- The Data Augmentation Dynamics environment could reduce the need for costly physical experiments and improve the development of AI and simulation models. The scale of this benefit has not yet been measured against a non-augmented baseline.
- The POLIMI methodology, INEGI testbed and other service-oriented results may generate value through consultancy, assessment, validation, demonstration or training. Their commercial value will depend on delivery time, staff costs, demand and the price customers are prepared to pay.

These examples provide a basis for further assessment in the future but should not be aggregated into a single estimate of the commercial value of FLASH-COMP. The figures relate to different types of result, use different assumptions and have not been validated through a common financial methodology.

7.6.3 Financial information not currently available

The reviewed documentation does not provide sufficient evidence to calculate the following reliably for most results:

- Final product, service, licence or subscription prices;
- Detailed costs of development, productisation, certification and market entry;
- Installation, integration, hosting, maintenance and customer-support costs;
- Gross margins or contribution margins;
- Customer acquisition and sales costs;
- Expected numbers of pilots, licences, subscriptions or deployments;
- Three-to-five-year sales and revenue forecasts;
- Break-even points or payback periods;
- The total investment required to reach market;
- Validated customer willingness to pay;
- Result-specific market shares that the responsible partners could realistically capture;
- Revenue and cost allocation between partners contributing to jointly exploited results.



It would not be appropriate to create these figures from broad market reports or technical assumptions alone. Global market size can indicate that a relevant industrial opportunity exists, but it does not demonstrate the revenue that a particular FLASH-COMP result will generate or the share that an individual partner can obtain.

The absence of complete financial projections does not remove the value of the current plans. It identifies the stage reached by the results and the commercial evidence that would be needed before a partner could make a fully informed investment or market-entry decision.

7.6.4 Evidence required for further commercial decisions

Where a partner decides that a result merits further commercial development, the next level of planning should be based on a defined use case and a specific customer or sector. As appropriate to the result, this should include:

- A clear description of the minimum commercial offer and the elements included within it;
- Recorded engineering, hardware, software, installation, hosting, training and support costs;
- A pilot price and a proposed price for subsequent commercial deployment;
- Quantification of customer benefits against an agreed baseline;
- Direct feedback on willingness to pay from potential customers or licensees;
- Comparison with the cost and performance of alternative solutions;
- An estimate of the additional investment required to complete development and validation;
- A realistic sales pipeline based on identifiable customers and accessible markets;
- Proposed licence, maintenance, subscription or service terms;
- For joint results, an agreement covering contracting, expenditure, liabilities, support and the distribution of revenues.

For a customer-facing industrial case, the commercial value assessment should compare the total cost of adoption with measurable benefits such as avoided scrap, reduced rework, shorter process time, lower inspection effort, reduced material and energy consumption, improved throughput and reduced quality risk. This would allow a potential customer to assess likely payback and allow the responsible partner to determine whether the proposed price and delivery model are sustainable.

7.6.5 Interpretation of the current business plans

The result-level plans in **Chapter 9** should consequently be understood as structured commercial and exploitation frameworks rather than complete investment-grade financial plans. They define the available propositions, possible customers, routes to market, dependencies, risks and next decisions using the evidence currently available.

For several results, the first realistic commercial activity is likely to be a paid pilot, integration assignment, collaborative development project, assessment service or licensing discussion. These activities would generate the technical, operational and customer evidence required to determine whether a repeatable and financially sustainable offer can be established.

The responsible partners will need to decide whether the strategic and commercial potential of each result justifies the further resources required to produce this evidence. Where no immediate commercial case is established, the result may still create value through integration into existing services, research collaboration, training, demonstration, knowledge reuse or future funded projects.



7.7. Use of the matrix in the detailed exploitation plans

The evidence matrix will act as the common source for the result-level planning chapters.

Table 9. Planning contents per each result type

Result type	Planning content
KER	Customer problem and value proposition; validation and TRL roadmap; market and competition; ownership and access rights; business model; route to market; pricing and delivery; risks; 12, 24 and 36-month actions.
ER	Role within the wider portfolio; validation and integration requirements; potential service, licence, internal-use or collaborative route; ownership and dependencies; follow-on funding; next-stage actions.
UR	Intended users; continued-use pathway; custodian; hosting, maintenance and access; reuse in training, standards, publications, proposals or future research; indicators of uptake and impact.

7.8. Conclusion

The completed questionnaires provide a strong basis for moving from a descriptive list of results to structured exploitation planning. They confirm that FLASH-COMP has created a portfolio with commercial, service, research, collaboration, training and positioning value. They also show that the portfolio is not yet uniformly market-ready. Industrial validation, quantified benefits, market engagement, data rights and joint governance are the most important conditions for the next stage.

8. BUSINESS, EXPLOITATION AND ACTION PLANS FOR PROJECT RESULTS

Purpose

This chapter presents the most complete business, exploitation and continued-use plans that can be prepared from the partner evidence available. It covers every agreed result, using substantive provisional plans where questionnaires have been returned.

KERs are addressed through business and market-development plans; ERs through exploitation, integration and maturity plans; and URs through stewardship, reuse and impact plans. Assumptions requiring further validation are identified so that they can be updated without changing the overall structure of the deliverable.

8.1. How to read the plans

Each plan follows a common structure covering current maturity and evidence, value proposition, target users, exploitation pathway, ownership and dependencies, risks, phased actions, progress indicators and remaining information needs.

The planning periods are expressed from the start of post-project exploitation activity and should be converted into calendar dates once partner commitments have been confirmed.



Table 10. Planning emphasis per each result type

Result category	Planning emphasis
KER	Customer problem, competitive value, business model, ownership, route to market, pricing evidence, industrial validation and commercial actions.
ER	Role within the portfolio, integration and validation requirements, potential service or collaboration route, ownership, follow-on funding and development actions.
UR	Intended users, stewardship, access, maintenance, continued use, knowledge transfer, positioning and evidence of uptake.

8.2. KER1 Combined Decision Support System

Table 11. KER1 Combined Decision Support System overview

KER overview	
Planning status	Full provisional business and exploitation plan updated following partner confirmation. The Combined DSS is a jointly owned result involving MSI, INEGI and LORTEK. It remains an integrated pilot and service proposition rather than a finished off-the-shelf product.
Responsible partners	MSI, INEGI and LORTEK as joint owners. INEGI is the proposed main exploiter for composite-manufacturing applications. MSI and LORTEK contribute their respective platform, analytical and AI capabilities.
Current maturity	TRL7 for bottom layers (descriptive, diagnostic, predictive) and TRL6 for higher layers (prescriptive and actuation)
Value proposition	The Combined DSS integrates MSI's generic Data Platform with process-specific data and data models, INEGI's simulation and composite-process capability, LORTEK's analytical and AI contribution, and DSS, HMI and decision-support functions. It provides contextual, stage-aware information to support operator decisions during liquid resin infusion.
Target users and sectors	Composite manufacturers, initially in marine and aerospace. Later replication may include wind energy, automotive and rail applications.
Exploitation pathway	Paid industrial pilots followed by integration and consulting services. A packaged or licensed joint offering could become possible once governance, validation and commercial responsibilities have been agreed.
Ownership and access	Shared ownership between MSI, INEGI and LORTEK is confirmed in principle. The precise ownership shares, potentially 33% each, remain to be agreed. Each partner retains its relevant background assets. Access, modification, commercial-use, support and revenue-sharing arrangements require a formal joint exploitation agreement.
Dependencies	MSI's generic Data Platform; process-specific industrial data and data models; INEGI's simulation capability; LORTEK's analytical and AI functions; DSS rules; HMI; reliable sensing inputs; integration interfaces; and industrial validation data.
Principal risks	Unconfirmed ownership percentages; unclear commercial and customer leadership; site-specific configuration; poor input data; integration complexity; insufficient operator acceptance; and uncertainty concerning MADE's continuing role.



Business and exploitation approach

The first offer should be framed as an INEGI-led industrial pilot supported by MSI and LORTEK rather than as an off-the-shelf licence. It should combine system integration, process-specific configuration, operator testing and measurement of manufacturing benefits.

Evidence from the first external pilot can then define a repeatable core solution, optional modules, implementation effort, support requirements and commercial terms. MSI, INEGI and LORTEK should retain the right to exploit their standalone technologies while granting the access required to configure, deliver and support the Combined DSS.

Benefits and pricing have not yet been quantified. The plan should develop a pilot price, implementation-effort estimate, annual support model and benefit case after common KPIs have been measured.

Action plan

Table 12. KER1 Action plan

Period	Priority actions	Expected output	Lead
0–12 months	Complete TRL 7 industrial validation; freeze the minimum pilot scope; agree foreground, access rights and commercial leadership; establish KPI baselines.	Validated pilot configuration and signed collaboration framework.	INEGI as proposed lead, with MSI and LORTEK; MADE's role to be confirmed
12–24 months	Secure and deliver an external paid pilot; measure defects, scrap, cycle time, operator use and implementation effort.	Reference case, quantified benefits and repeatable delivery method.	Agreed commercial lead
24–36 months	Package the core and optional modules; establish sales, support and maintenance processes; replicate the solution in a second sector.	Market-facing offer and first repeat-customer pathway.	Joint exploitation team

Progress indicators

- TRL 7 evidence completed and accepted.
- Joint exploitation agreement signed.
- At least one external pilot commitment and one completed pilot.
- Manufacturing and usability KPIs measured against an agreed baseline.
- Implementation price, support terms and partner revenue allocation defined.

Information to confirm: Precise ownership percentages; formal acceptance of INEGI as main exploiter; MADE's role; customer and contracting leadership; responsibilities for integration, hosting, maintenance and support; revenue-sharing arrangements; validated customer benefits; pricing; willingness to pay; and external demand evidence.



8.3. KER2 FLASH COMP Data Platform

Table 13. KER2 FLASH COMP Data Platform overview

KER overview	
Planning status	Full business plan based on the MSI questionnaire and subsequent partner confirmation. The result is MSI's generic, sector-independent data architecture and excludes sector- or process-specific data, data models and algorithms.
Responsible partner	MSI, 100% owner and main exploiter
Current maturity	TRL7. Development is reported as complete, although industrial validation remains to be fully evidenced.
Value proposition	A reusable industrial architecture for acquiring, harmonising, storing, exchanging and making data available across heterogeneous equipment, systems and facilities. Process-specific data, data models and algorithms connect to the platform but are not part of the owned platform result.
Target users and sectors	Industrial companies requiring integration of heterogeneous production data. Initial evidence comes from composite manufacturing; MSI foresees replication in sectors including paper and steel.
Exploitation pathway	MSI-led integration projects, software licences, maintenance and support. The platform may be deployed independently, adapted to different industrial sectors or supplied as the generic architecture within the Combined DSS.
Ownership and access	MSI owns the Data Platform in full. Customer data, sector-specific data models, third-party components and application-specific algorithms remain subject to their own ownership and access conditions.
Dependencies	Customer infrastructure, legacy interfaces, cybersecurity requirements, data availability and customer digital maturity.
Principal risks	Complex legacy integration, cybersecurity, concerns about vendor dependency, insufficient reference evidence and variable implementation effort.

Business and exploitation approach

MSI should define and document the standard generic architecture, its interfaces and its integration, cybersecurity, maintenance and support packages. The commercial offer should clearly separate the reusable platform core from customer data, sector-specific models and application algorithms.

A reference implementation in composite manufacturing should demonstrate the platform both as a standalone industrial data architecture and as the generic data layer supporting the Combined DSS. Replication can then be pursued in other sectors, including paper and steel, using sector-specific connectors and configurations without treating those application assets as part of the generic platform ownership.

The questionnaire indicates a typical deployment value of €30,000–€60,000 and an estimated 30–50% reduction in integration engineering effort. Both figures require substantiation before they are used externally.



Action plan

Table 14. KER2 Action Plan

Period	Priority actions	Expected output	Lead
0–12 months	Complete and document real-environment validation; define the standard deployment scope; validate cybersecurity and support requirements.	TRL 7 evidence and deployment specification.	MSI
12–24 months	Deliver the first commercial reference deployment; document integration hours, system performance and user outcomes; formalise licence and maintenance terms.	Reference case and repeatable commercial package.	MSI
24–36 months	Expand connectors and sector templates; integrate with further analytics and digital-twin offers; develop partner channels.	Cross-sector growth and recurring support revenue.	MSI

Progress indicators

- One documented TRL 7 industrial deployment.
- Actual deployment costs and engineering hours recorded.
- Licence, maintenance and service terms approved.
- Customer satisfaction and platform-availability measures recorded.
- At least one deployment beyond the initial composite-manufacturing case.

Information to confirm: Evidence supporting price and efficiency assumptions; industrial reference results; cross-sector customer evidence; detailed competitive positioning; standard deployment boundaries; and the treatment of customer data and third-party application components.

8.4. KER3 INEGI Simulation Tool

Table 15. KER3 INEGI Simulation Tool overview

KER overview	
Planning status	Placeholder business plan pending INEGI's dedicated questionnaire. Earlier project discussions indicate that the simulation capability can retain standalone value while also acting as a central analytical component of the DSS.
Responsible partner	INEGI
Current maturity	TRL7
Value proposition	Process-simulation algorithms that interpret material, geometry and process data and predict infusion behaviour.
Target users and sectors	LRI Composite manufacturers, engineering teams and providers of monitoring or decision-support systems.
Exploitation pathway	Initially exploit the tool through consultancy and process-engineering services focused on infusion optimisation, virtual process validation and manufacturing support. In a second stage, the tool will be integrated with monitoring technologies and DSS functionalities developed in FLASH-COMP, enabling real-time comparison between predicted and observed flow-front behaviour and providing advanced decision support to operators. Long-term exploitation may include licensing of the simulation technology and deployment within digital



	manufacturing platforms for composite production, targeting sectors such as marine, aerospace, wind energy and other large composite structure applications.
Ownership and access	Ownership, background software, licences and access rights must be confirmed.
Dependencies	Material data, CAD geometry, process inputs, validation data and interfaces to sensing, platform and DSS components.
Principal risks	Unconfirmed readiness, model accuracy and transferability, computation and integration requirements, and unclear commercial packaging.

Business and exploitation approach

As an RTO, INEGI is likely to first offer a service for customers or co-funded projects. If it gains strong market appeal, there is a possibility for a spinoff/startup to be established.

Two candidate routes should be assessed:

1. An engineering simulation and analysis service delivered directly to manufacturers.
2. A software component supplied to platform or DSS integrators.

Action plan

Table 16. KER3 Action Plan

Period	Priority actions	Expected output	Lead
0–6 months	Complete the questionnaire; define the software boundary, validation evidence, ownership and target use cases.	Agreed result profile.	INEGI
6–18 months	Validate models against industrial trials and define a service or licence package.	TRL and commercial-route evidence.	INEGI
18–36 months	Run an external pilot and assess standalone and DSS-related demand.	Reference case and confirmed business model.	INEGI with partners

Progress indicators

- Questionnaire completed.
- Model accuracy and validation criteria agreed.
- Software interfaces and ownership documented.
- At least one external pilot or simulation-service engagement.

Information to confirm: TRL, ownership, target market, validation results, costs, pricing, software requirements and development roadmap.

8.5. KER4 Hyperspectral Imaging Curing Monitoring

Table 17. KER4 Hyperspectral Imaging Curing Monitoring overview

KER overview	
Planning status	Full provisional business and development plan based on the LORTEK questionnaire. The current result is technically promising but not ready for direct sale. Partner discussions suggest that gel-time prediction may have greater customer value than curing-degree monitoring alone. The next phase should validate this use case and develop a lower-cost sensing architecture.



Responsible partner	LORTEK.
Current maturity	TRL 6 for aviation and TRL 7 for naval.
Value proposition	Spatial, real-time estimation of curing progress through near-infrared absorption changes, potentially improving process timing and identifying curing behaviour.
Target users and sectors	Manufacturers using visible or semi-open mould composite-curing processes, although not limited to these sectors.
Exploitation pathway	Collaborative industrial development followed by licensing or inclusion within a monitoring and DSS package.
Ownership and access	LORTEK claims sole ownership. Dependence on the current Specim camera and related restrictions should be removed or clarified.
Dependencies	Optical access, camera hardware, calibration data, frontend development and links to the Data Platform or DSS.
Principal risks	High hardware cost, insufficient industrial validation, supplier dependency and the possibility that the current proposition does not address the strongest customer need.

Business and exploitation approach

LORTEK should pursue collaborative industrial projects that fund application development and validation. A staged offer could begin as a specialist monitoring and analysis service before a stable algorithm and affordable hardware configuration are licensed or packaged.

The current HSI camera is indicated at approximately €40,000. The suggested mould-time reduction of at least 5% is provisional and must be demonstrated.

Action plan

Table 18. KER4 Action Plan

Period	Priority actions	Expected output	Lead
0–12 months	Confirm customer priorities through interviews; define gel-time performance requirements; complete the industrial validation plan; review camera licences.	Validated use case and technical specification.	LORTEK
12–24 months	Develop gel-time prediction and a lower-cost optical architecture; run an industrial trial; quantify cycle-time and defect outcomes.	TRL 7 evidence and affordable prototype.	LORTEK with industrial partner
24–36 months	Select a licence or monitoring-service model; integrate with the platform or DSS; secure the first commercial application.	Commercial package or paid service.	LORTEK

Progress indicators

- Customer interviews and ranked use cases documented.
- Industrial accuracy, repeatability and timing KPIs achieved.
- Hardware cost reduced against the present configuration.
- At least one paid collaborative project or licence discussion.

Information to confirm: Validated demand, gel-time performance, hardware cost target, freedom to operate, quantified savings and final pricing.



8.6. KER5 FLASH FOS Monitoring System

Table 19. KER5 FLASH FOS Monitoring System overview

KER overview	
Planning status	Full provisional business and development plan based on the AIMEN questionnaire. FOS monitoring provides a differentiated route for parts and processes that cannot be observed effectively using cameras. Commercialisation depends on proving repeatable installation and interpretation in industrial conditions and identifying an integrator capable of productising and supporting the solution.
Responsible partner	AIMEN
Current maturity	TRL 5, with TRL 6–7 targeted. Approximately 85% complete.
Value proposition	Embedded point and distributed fibre-optic sensing for vacuum, flow, temperature, curing and defect-related events where optical monitoring is impractical.
Target users and sectors	Marine, wind and aerospace composite manufacturers and specialist FOS solution integrators.
Exploitation pathway	Licensing to a FOS integrator, potentially combining sensors and data acquisition with software or subscription services. The system could operate independently or as part of the DSS.
Ownership and access	AIMEN owns the backend. Frontend development may involve MSI or LORTEK. Know-how and code require controlled access.
Dependencies	Industrial installation methods, trained operators, frontend development, sensing hardware, certification, an external licensee and integration interfaces.
Principal risks	Absence of an engaged licensee, cost and installation skill, certification, competing technologies and leakage of protected know-how.

Business and exploitation approach

Industrial validation should be used to produce a technical package for potential licensees. This should cover supported configurations, installation methods, training data, performance limits, interface specifications and the certification route.

Initial revenue is more likely to arise from collaborative validation and technology-transfer activities than direct product sales.

Action plan

Table 20. KER5 Action Plan

Period	Priority actions	Expected output	Lead
0–12 months	Complete industrial trials; improve the frontend; document installation and training requirements; define the licensee profile.	TRL 6–7 evidence and technology-transfer package.	AIMEN
12–24 months	Approach a shortlist of integrators; run a joint demonstrator; agree certification requirements and licence heads of terms.	Selected commercial partner and validation agreement.	AIMEN with prospective licensee



24–36 months	Complete productization, training and the first licensed deployment; integrate with the DSS where valuable.	First commercial deployment and support model.	Licensee with AIMEN
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Progress indicators

- Industrial scenarios validated.
- Installation repeatability and sensing accuracy documented.
- Qualified integrator shortlist prepared and approached.
- Licence or co-development agreement signed.
- First sector deployment completed.

Information to confirm: Verified market sources, price and revenue model, active licensee discussions, certification plan and frontend ownership.

8.7. ER1 Defect Estimation Tool DSET

Table 21. ER1 Defect Estimation Tool DSET overview

ER overview	
Planning status	Full provisional exploitation plan based on the LORTEK questionnaire. DSET should be exploited as an enabling analytics component rather than presented as an independent commercial product at this stage.
Responsible partner	LORTEK, with technical dependencies on INEGI and MSI.
Current maturity	TRL 6, with TRL 7 targeted.
Value proposition	Algorithms estimate defect severity, particularly dry-spot risk, using sensor and simulation information.
Target users and sectors	Composite-infusion manufacturers and providers of integrated ZDM solutions.
Exploitation pathway	An analytics component embedded within monitoring, simulation or DSS solutions.
Ownership and access	LORTEK claims sole ownership, although access to partner data and interfaces is required.
Dependencies	Sensor signals, simulation outputs, testbed and industrial data, and a host frontend or DSS.
Principal risks	Industrial validation remains incomplete, no exploitation lead or funded roadmap has been agreed, and the result has limited standalone commercial value.

Exploitation approach

The priority is to complete testbed and industrial validation and agree which partner offer will host DSET. A funded integration route is needed to prevent the algorithm from becoming an isolated or unused project result.

Action plan

Table 22. ER1 Action Plan

Period	Priority actions	Expected output	Lead
0–12 months	Complete INEGI and AZIMUT validation; define performance metrics and the host offer.	TRL 7 evidence and integration decision.	LORTEK with INEGI



12–24 months	Integrate DSET into the selected platform or DSS; secure follow-on funding or a paid pilot.	Operational integrated component.	LORTEK and host owner
24–36 months	Replicate across further infusion cases and refine its commercial contribution.	Reusable analytics module.	Integration partners

Progress indicators

- Accuracy and false-alarm measures validated.
- Exploitation lead and host solution named.
- Funded integration plan established.
- At least one industrial deployment completed.

Information to confirm: Validation results, business owner, pricing contribution, post-project budget and access rights.

8.8. ER2 Data Augmentation Dynamics

Table 23. ER2 Data Augmentation Dynamics overview

ER overview	
Planning status	Full exploitation plan updated following confirmation that the environment is owned and exploited entirely by MSI.
Responsible partner	MSI, 100% owner and main exploiter
Current maturity	TRL 4–5, with TRL 6–7 targeted.
Value proposition	An environment for creating process-specific synthetic data for AI development, simulation and validation where sufficient representative industrial data are unavailable.
Target users and sectors	MSI's industrial clients and project partners developing AI, simulation, digital-twin, validation and decision-support applications across multiple sectors.
Exploitation pathway	An MSI-owned enabling capability incorporated into paid AI, simulation, validation and industrial-digitalisation projects. It may also support selected Combined DSS developments.
Ownership and access	MSI owns the Data Augmentation Dynamics environment in full. Source-dataset ownership does not transfer to MSI; each application must respect the relevant confidentiality, access and permitted-use conditions.
Dependencies	Representative source data; appropriate data-use permissions; process knowledge; validation benchmarks; downstream AI or simulation models; and user confidence in synthetic outputs.
Principal risks	Synthetic bias; poor generalisation; insufficient validation; source-data restrictions; unquantified downstream benefits; and limited user trust.

Exploitation approach

MSI should benchmark the environment against non-augmented baselines, automate the workflow and incorporate it into selected AI, simulation and validation offers. Commercial value can be recovered through MSI-led projects, licences or services rather than requiring joint ownership of the underlying environment.



Action plan

Table 24. ER2 Action Plan

Period	Priority actions	Expected output	Lead
0–12 months	Secure additional datasets and permissions; define benchmarks; quantify improvement in downstream applications.	TRL 6 evidence and data-rights record.	MSI; data providers confirm permissions
12–24 months	Automate the workflow; integrate it into MSI's portfolio; validate across multiple scenarios.	Reusable internal component.	MSI
24–36 months	Use the capability in paid AI projects and selected DSS developments.	Commercially evidenced enabling capability.	MSI

Progress indicators

- Number and diversity of validated datasets.
- Measured AI improvement against baseline.
- Data permissions documented.
- Reduction in data-collection or model-development effort.
- Use in at least one paid project.

Information to confirm: Quantified improvement in AI, simulation or validation performance; validation across additional processes and sectors; source-data permissions for each application; delivery model; pricing contribution; and examples of use in paid projects.

8.9. ER3 INEGI Testbed

Table 25. ER3 INEGI Testbed overview

ER overview	
Planning status	The testbed is expected to be a strategic ER whose value comes from services, technology validation, industrial demonstrations, training activities and the expansion of INEGI's research and innovation portfolio, rather than from the commercial sale of the facility itself.
Responsible partner	INEGI
Current maturity	TRL6
Value proposition	Demonstration of sensors, data collection, analysis and simulation, providing a platform for validation, training, client engagement and future research. Testbed for industry on digitisation pathway.
Target users and sectors	Developers and users of industrial AI, digital twins, predictive analytics and DSS solutions.
Exploitation pathway	Industrial clients, researchers, students, training activities, project consortia and technology developers. Where appropriate, INEGI may also explore licensing or technology-transfer opportunities related to specific test protocols, validation methodologies, operating procedures, data-processing approaches, and replicable Test Bed configuration know-how.



Ownership and access	Available equipment, staff, operating procedures, access policies and connections to FLASH-COMP technologies.
Dependencies	The value of the test bed depends on the availability and maintenance of the physical LRI infrastructure, monitoring and sensing technologies, data acquisition systems, simulation and DSS components and industrial use cases and validation activities
Principal risks	No defined service catalogue, capacity or funding model; uncertain maintenance and utilisation.

Exploitation approach

INEGI will consolidate the Test Bed as a pre-industrial validation, demonstration, and training platform. This will include defining a service catalogue, access model, target users, capacity, pricing or cost-recovery approach and research pipeline.

Action plan

Table 26. ER3 Action Plan

Period	Priority actions	Expected output	Lead
0–6 months	Complete the questionnaire and inventory capabilities, users, costs and access conditions.	Agreed testbed profile.	INEGI
6–18 months	Package demonstration, training and validation services; host the first external activity.	Operational service offer.	INEGI
18–36 months	Use the testbed in new projects, theses and industrial collaborations; track utilisation.	Sustained research and industry pipeline.	INEGI

Progress indicators

- Questionnaire completed.
- Service catalogue and access model published.
- Number of demonstrations, training sessions and external users.
- New projects and industrial collaborations supported.

Information to confirm: TRL, ownership, operating costs, capacity, service model, pricing and intended users.

8.10. ER4 Industrial Demonstrators

Table 27. ER4 Industrial Demonstrators overview

ER overview	
Planning status	Exploitation plan based on the AZIMUT form. The demonstrators provide evidence that makes other FLASH-COMP results credible while strengthening AZIMUT's positioning in sustainable and advanced manufacturing.
Responsible partner	AZIMUT and IAI for their respective demonstrators, while technology partners retain rights in the underlying technologies.
Current maturity	TRL 6, with TRL 7 targeted.
Value proposition	Industrial proof that FLASH-COMP sensing, simulation, analytics and interfaces can improve infusion quality and support advanced, lower-waste manufacturing.



Target users and sectors	Internal production and engineering teams, prospective clients, collaborators and future project partners.
Exploitation pathway	Internal adoption, industrial validation, marketing, sustainability positioning and collaboration rather than direct sale of the demonstrator.
Ownership and access	Underlying technologies remain partner-owned. Rights relating to validation data, images, results and public claims require agreement.
Dependencies	INEGI and LORTEK technologies, platform and interface readiness, successful industrial trials and measurable KPIs.
Principal risks	Results are not yet fully defined, KPIs remain unproven, engineering scale-up may be required, IAI input is incomplete and manufacturing know-how must be protected.

Exploitation approach

Each demonstrator requires a validation protocol, internal adoption decision and communications plan. Public claims should use measured outcomes and respect confidentiality. The two partner cases should be presented consistently while retaining their sector-specific benefits.

Action plan

Table 28. ER4 Action Plan

Period	Priority actions	Expected output	Lead
0–12 months	Complete AZIMUT and IAI trials; agree baselines and KPIs; capture approved evidence.	TRL 7 validation and two completed result profiles.	AZIMUT and IAI
12–24 months	Decide internal adoption; use demonstrators in client, partner and dissemination activities.	Internal roadmap and approved marketing assets.	Industrial partners
24–36 months	Use evidence in new projects, supplier engagement and capability development.	Continued collaboration and positioning benefits.	Industrial partners

Progress indicators

- Both partner inputs completed.
- Quality, waste, cycle-time and sustainability outcomes measured.
- Internal adoption decisions recorded.
- Number of client demonstrations and follow-on collaborations.

Information to confirm: IAI submission, completed industrial results, approved KPIs, continued-use commitments and data/publication rights.

8.11. ER5 Manufacturing Sustainability and ZDM Maturity Methodology

Table 29. ER5 Manufacturing Sustainability and ZDM Maturity Methodology overview

ER overview	
Planning status	Full provisional exploitation plan based on the POLIMI questionnaire. The methodology has a credible service and research route but requires broader validation before strong claims can be made regarding repeatability across sectors.



Responsible partner	POLIMI.
Current maturity	TRL 6. The next target is to be confirmed.
Value proposition	Assessment of readiness across the process, product, platform, performance, people and partnership dimensions, producing a roadmap for digital and ZDM adoption.
Target users and sectors	Manufacturers planning digitalisation and ZDM initiatives, and research and innovation projects.
Exploitation pathway	Assessment and advisory services, research application and reuse in future projects.
Ownership and access	POLIMI claims sole ownership. The methodology builds on background 6Ps work and is protected through copyright and know-how.
Dependencies	Access to a diverse validation panel, trained assessors and a repeatable delivery protocol.
Principal risks	Limited external validation, unclear service packaging and pricing, and dependence on follow-on funding.

Exploitation approach

POLIMI should convert the research method into a defined assessment process covering inputs, interviews, scoring, outputs, delivery effort and the resulting implementation roadmap. Validation with a diverse industrial panel should precede wider promotion.

Action plan

Table 30. ER5 Action Plan

Period	Priority actions	Expected output	Lead
0–12 months	Recruit an external panel; apply the method; collect feedback and test repeatability.	Validated method and revised protocol.	POLIMI
12–24 months	Define the assessment service, report template, delivery effort and pricing approach; deliver initial engagements.	Repeatable service package.	POLIMI
24–36 months	Apply the methodology across projects and sectors; publish aggregated learning where permitted.	Broader evidence and collaboration pipeline.	POLIMI

Progress indicators

- Number and diversity of organisations assessed.
- Repeatability and user-feedback measures.
- Defined delivery time and service package.
- Use in external projects or company engagements.

Information to confirm: Next TRL target, external validation results, service price, delivery resources and demand evidence.



8.12. UR1 Training Modules and Learning Materials

Table 31. UR1 Training Modules and Learning Materials overview

UR overview	
Planning status	Full continued-use plan based on the ESTIA questionnaire. The training materials are a clear UR. Their exploitation value lies in durable access, reuse, adaptation and evidence of learning rather than direct sales.
Responsible partner	ESTIA, with industrial partners as internal users.
Value proposition	Transfer of FLASH-COMP knowledge to engineering students and industrial operators, supporting adoption of digital and ZDM methods.
Target users and sectors	Fourth and fifth-year engineering students, AZIMUT and IAI operators, and participants in future projects.
Continued-use pathway	Open education, internal training and adaptation in future projects.
Ownership and access	Online student materials are intended for release under CC BY-SA 4.0. Rights relating to all embedded content should be confirmed.
Dependencies	Final content, hosting, maintenance, partner feedback and periodic technical updates.
Principal risks	Limited uptake, outdated material, unclear hosting or custodianship and incomplete rights coverage.

Continued-use approach

ESTIA should finalise a modular package, publish it in a stable repository, define maintenance responsibility and provide an internal deployment version for industrial partners.

Action plan

Table 32. UR1 Action Plan

Period	Priority actions	Expected output	Lead
0–12 months	Finalise and quality-check the materials; confirm licences; publish the modules and deliver initial operator sessions.	Released modules and training record.	ESTIA
12–24 months	Collect feedback; update examples; reuse materials in courses and new projects.	Improved second version and uptake evidence.	ESTIA
24–36 months	Maintain the repository and track adaptations, users and partner reuse.	Sustained educational legacy.	ESTIA

Progress indicators

- Modules completed and accessible.
- Number of students and operators trained.
- User feedback and learning measures.
- Number of courses, partners and projects reusing the material.

Information to confirm: Final repository, maintenance owner, complete rights review, delivery schedule and uptake targets.



8.13. UR2 Standardisation Roadmap

Table 33. UR2 Standardisation Roadmap overview

UR overview	
Planning status	Full continued-use plan based on the MADE questionnaire.
Responsible partner	LORTEK and MADE contributors. A central custodian remains to be appointed.
Value proposition	Identification of relevant technical, data, process and interoperability standards, helping partners align future development and avoid duplicated work.
Target users and sectors	FLASH-COMP partners, composite manufacturers, technology providers, proposal teams and standards bodies.
Continued-use pathway	Reference for KER development, future proposals, standards engagement, internal procedures, training and consultancy.
Ownership and access	Ownership and update responsibilities have not been stated.
Dependencies	A named custodian, prioritised actions, links to KER owners and monitoring of relevant standards activity.
Principal risks	The roadmap remains static, priorities are too broad, no partner follows up the actions, or the standards landscape changes.

Continued-use approach

The roadmap recommendations should be converted into a concise action register linked to the KER development plans. Each action should have an owner, target standard or standards body, deadline and expected contribution.

Action plan

Table 34. UR2 Action Plan

Period	Priority actions	Expected output	Lead
0–12 months	Assign a custodian; rank the gaps; connect actions to KER owners and relevant committees.	Owned standardisation action register.	MADE and WP8
12–24 months	Engage selected bodies or clusters; use the roadmap in proposals and development reviews.	Documented external and internal use.	Assigned action owners
24–36 months	Review standards developments and update priorities; capture contributions to market access and interoperability.	Maintained roadmap and evidence of use.	Appointed custodian

Progress indicators

- Custodian and action owners named.
- Number of prioritised actions completed.
- Standards bodies, clusters and proposals engaged.
- Documented changes to KER specifications or procedures.



Information to confirm: Responsible contact, ownership, target committees, deadlines and formal partner commitments.

8.14. UR3 Scientific Publications

Table 35. UR3 Scientific Publication overview

UR overview	
Planning status	Continued-use plan pending a consolidated publication return and confirmation of the planned post-project dissemination activities. Scientific publications are a UR rather than a commercial product. Their exploitation plan demonstrates how published knowledge will remain discoverable, accessible and reusable, and how it will support partner positioning, knowledge transfer, collaboration and future research. This includes academic publications as well as the continued communication and interpretation of project findings for wider industrial and innovation audiences.
Responsible partner	Contributing research partners and publication authors, with Insight Media supporting wider dissemination, editorial reuse and engagement with external networks, including its own publication Projects Magazine and its co-management of the 4ZDM cluster.
Value proposition	Dissemination of scientific and technical knowledge; support for partner credibility and positioning; avoidance of duplicated research; and creation of an evidence base for follow-on studies, proposals and collaboration. The results also provide material that can be translated into accessible editorial content for industrial and policy audiences through Insight Media and Projects Magazine. Continued cooperation with the 4ZDM cluster and its sister projects provides an additional route for joint publications, shared communication activities and the promotion of complementary advances in zero-defect manufacturing.
Target users and sectors	Researchers, industrial R&D teams, manufacturing companies, future project consortia, students, policymakers and relevant technical communities. Further audiences include the readership of Projects Magazine, members of the 4ZDM cluster, sister-project networks and stakeholders interested in zero-defect manufacturing, industrial digitalisation and sustainable manufacturing.
Continued-use pathway	Open-access dissemination where permitted; conference, workshop and teaching use; citations and research reuse; and use of publications as evidence in future proposals and collaborative research. Insight Media can support the continued interpretation and promotion of results through Projects Magazine, project features, interviews, articles and related editorial material. Relevant findings can also be disseminated through the 4ZDM cluster, including joint communication with sister projects, contributions to cluster publications and events, cross-project thematic material and the identification of common research and exploitation opportunities.
Ownership and access	Publication-specific copyright, authorship, data and open-access conditions apply. Academic reuse, editorial adaptation and joint publication with sister projects must respect the permissions of authors, publishers and result owners, as well as any confidentiality restrictions applying to the underlying project results and data.



Dependencies	A complete publication register; stable repository and publication links; author commitments; permission to reuse underlying information, data and visual material; coordination with Insight Media, Projects Magazine, the 4ZDM cluster and relevant sister projects. Effective continued use will also depend on identifying findings that can be communicated appropriately to both specialist and non-specialist audiences.
Principal risks	Fragmented publication records; Cluster-based activities will also depend on continued engagement and alignment with the communication schedules and priorities of sister projects.

Continued-use approach

Monitoring of formal scientific publications and subsequent uses of their findings, including conference presentations, teaching, proposals, Projects Magazine content, Insight Media communications, 4ZDM cluster activities and joint material produced with sister projects.

This will highlight how knowledge is published, but also how it continues to circulate and generate value, even after the project ends.

Action plan

Table 36. UR3 Action Plan

Period	Priority actions	Expected output	Lead
0–6 months	Complete a publication register, verify access arrangements and identify outputs suitable for further academic, editorial and cluster dissemination.	Consolidated publication and reuse register.	WP8, authors and Insight Media
6–18 months	Promote and repurpose relevant findings through conferences, partner channels, Projects Magazine and coordinated activity with the 4ZDM cluster and sister projects.	Evidence of wider dissemination, engagement and cross-project knowledge exchange.	Authors, partners and Insight Media
18–36 months	Use publications and related content to support further research, proposals, collaborations and industry engagement, while recording resulting impacts.	Evidence of continued knowledge exploitation and follow-on activity.	Research partners and WP8

Progress indicators

- Complete and maintained publication and reuse register.
- Proportion of outputs openly accessible where permitted.
- Citations, downloads, conference presentations and teaching use.
- Articles, interviews or features published through Projects Magazine and other Insight Media channels.
- FLASH-COMP contributions to 4ZDM cluster publications, events and communication activities.
- Joint or coordinated material produced with sister projects.
- Evidence of engagement from industrial, research and policy audiences.



- Follow-on proposals, studies, collaborations and enquiries linked to publications or related editorial content.
- Examples of publications informing or preventing duplication in subsequent research.

8.15. Action plans conclusion

The portfolio presents a coherent set of result-level plans rather than a list of outputs. The questionnaires support substantive plans for the DSS, Data Platform, HSI and FOS monitoring, DSET, Data Augmentation Dynamics, industrial demonstrators, the POLIMI methodology, training modules and standardisation roadmap.

The plans remain intentionally evidence-led. Ownership of MSI's Data Platform and Data Augmentation Dynamics is confirmed as MSI, 100%. Shared ownership of the Combined DSS between MSI, INEGI and LORTEK is confirmed in principle.

The remaining issues concern the precise DSS ownership percentages, formal exploitation leadership, delivery and support responsibilities, revenue allocation, MADE's continuing role, completion of industrial validation and validation of market demand.

9. TARGETED AUDIENCE ENGAGEMENT AND EXPLOITATION HANDOVER STRATEGY

9.1. Purpose

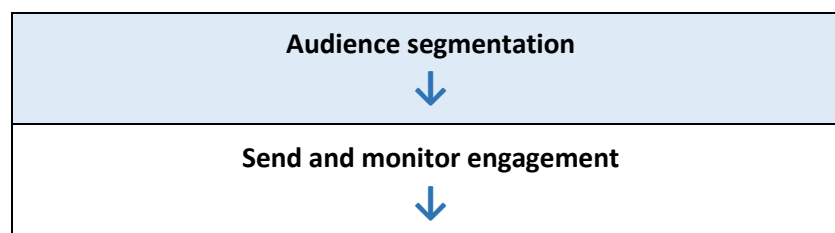
FLASH-COMP's communication activity connects specific project results with organisations and individuals whose known interests indicate that those results may be relevant to them.

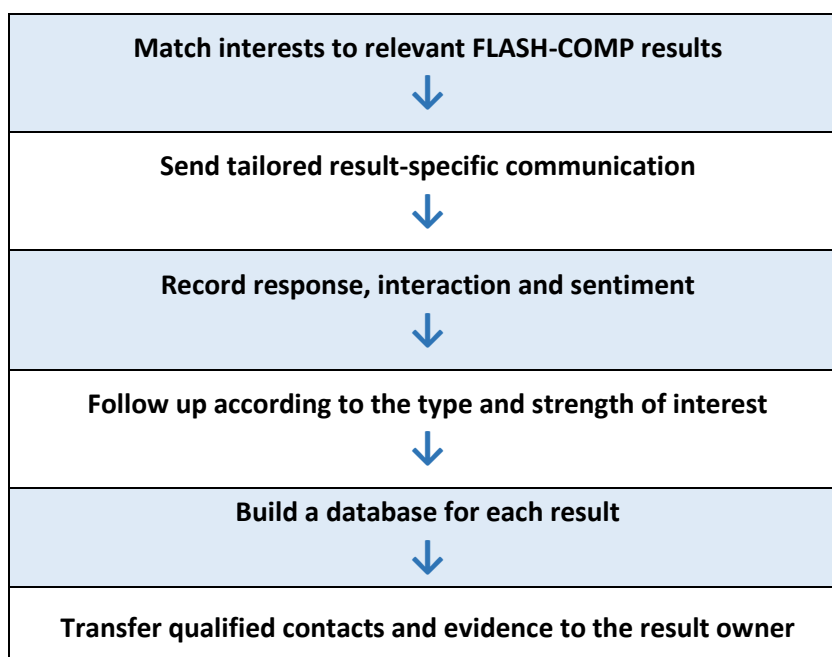
The purpose is not to sell the results as market-ready products. Instead, the activity:

- Build awareness of relevant FLASH-COMP outcomes among targeted audiences;
- Establish and maintain contact with potential users, adopters and collaborators;
- Identify interest in further development, testing, application or reuse;
- Record interactions, questions and sentiment;
- Create a result-specific stakeholder database; and
- Transfer qualified contacts and engagement evidence to the relevant result owners and exploiters.

The resulting databases are a practical outcome of WP8. They give result owners a starting point for future exploitation activity should they decide that further development, investment or collaboration is justified.

Engagement process





9.2. Audience segmentation

Insight Media has used the interests and previous engagement of stakeholders within its networks to segment potential audiences. Contacts have been matched only with results relevant to their known sector, technical interests or organisational needs.

Principal audience segments include:

- Composite manufacturers and industrial end users;
- Technology providers and systems integrators;
- AI, data-platform and industrial-digitalisation specialists;
- Research and technology organisations;
- Universities, colleges and training providers;
- Sustainability, ZDM and organisational-readiness specialists;
- Industry clusters and associations;
- Standardisation and certification stakeholders;
- Potential partners for industrial pilots and future research projects;
- Wider industrial, research and policy audiences.

9.3. Result-level engagement matrix

Table 37. Result-level engagement matrix

Result	Priority audiences	Engagement message	Potential opportunity/outcome
Combined DSS	Composite manufacturers, systems integrators,	Introduction to the integrated decision-support concept and its potential role in LRI	Interest in further discussion, validation, pilot activity or collaborative development



	industrial R&D teams and ZDM specialists	monitoring and operator support	
Data Platform	Manufacturers, industrial digitalisation teams, data integrators and technology providers	Reusable data architecture for connecting heterogeneous industrial data sources and digital applications	Identification of integration opportunities, sector replication or future customer requirements
Simulation Tool	Composite manufacturers, engineering teams, simulation providers and research organisations	Simulation and modelling capabilities for understanding and supporting LRI processes	Interest in simulation services, validation, integration or collaborative research
Hyperspectral Imaging	Composite manufacturers, imaging specialists, equipment providers and industrial R&D teams	Spatial, real-time monitoring of curing-related conditions and potential future gel-time applications	Feedback on use cases, hardware-cost requirements, trials and collaborative development
FOS Monitoring System	Composite manufacturers, FOS integrators, sensor providers and industrial R&D organisations	Monitoring of process conditions in locations and components that cannot be observed effectively by cameras	Identification of potential licensees, integrators, validation partners and application cases
DSET	DSS and platform owners, AI specialists, composite manufacturers and research organisations	AI-supported defect-estimation capability requiring further integration and validation	Identification of a host solution, funded integration opportunity or research collaboration
Data Augmentation Dynamics	AI developers, manufacturers with limited datasets, simulation specialists and research organisations	Creation of synthetic, process-specific data for AI, simulation and validation	Identification of datasets, validation cases, paid project applications or further research
INEGI Testbed	Manufacturers, technology developers, researchers, trainers and future consortia	Environment for testing, demonstrating, integrating and training with sensing, data and simulation technologies	Requests for demonstrations, testing, training, collaborative research or proposal participation
Industrial Demonstrators	Potential customers, industrial partners, clusters and research consortia	Evidence of FLASH-COMP technologies being applied in industrially relevant	Increased credibility, client engagement, internal adoption and future collaboration



		marine and aerospace settings	
6Ps ZDM Maturity Methodology	Manufacturers, consultants, digitalisation specialists, industry associations and research projects	Structured assessment of organisational readiness for digitalisation and ZDM implementation	Requests for assessments, advisory support, reuse in projects or adaptation to new sectors
Training Modules	Universities, colleges, training providers, manufacturers and industrial-skills organisations	Accessible learning resources covering FLASH-COMP, digital manufacturing and ZDM-related capabilities	Adoption in courses, operator training, curriculum reuse and feedback
Standardisation Roadmap	Technology owners, standards organisations, clusters, certification bodies and future projects	Guidance on relevant standards, gaps and considerations affecting future development and deployment	Use in technical planning, standards engagement, proposals and certification preparation
Scientific Publications	Researchers, industrial R&D teams, educators, policymakers and future project consortia	Access to FLASH-COMP's scientific and technical knowledge and its relevance to further research and industrial innovation	Downloads, citations, teaching use, editorial reuse, proposals and research collaboration

9.4. Contact process

Communications have been tailored to the result and audience but have followed a common process.

Table 38. Contact process stages

Stage	Communication	Purpose
Initial contact	Short, personalised email from Insight Media on behalf of FLASH-COMP	Explain why the specific result may be relevant to the contact and provide concise supporting information
Information follow-up	Result summary, publication, video, demonstrator evidence, training link or other relevant material	Enable the recipient to assess the result without presenting it as a finished commercial product
Engagement follow-up	Email, telephone call or online meeting where interest is indicated	Understand the recipient's use case, questions, needs and preferred form of future engagement
Specialist referral	Introduction to the responsible partner or exploiter, where appropriate and agreed	Allow technical, research or exploitation discussions to continue directly
Handover	Transfer of the result-specific contact database and engagement record	Provide the result owner with qualified leads and evidence for possible post-project activity



Separate email variants were prepared for:

- Potential industrial users and adopters;
- Technology providers and integrators;
- Research and collaborative-project partners;
- Education and training organisations;
- Methodology and consultancy users;
- Standardisation and certification stakeholders; and
- Scientific and knowledge-reuse audiences.

Each email identifies the result, explains its relevance to that audience, accurately describes its current maturity and invites an appropriate next step. Calls to action focus on discussion, feedback, application, validation, collaboration or reuse—not immediate purchase.

9.5. Interaction and sentiment tracking

A separate database view or register is being maintained for each result. It includes:

Table 39. Database components for results related interaction

Field	Information recorded
Result	Relevant KER, ER or UR
Organisation and contact	Name, role, organisation and professional contact details
Audience segment	Manufacturer, integrator, researcher, educator, standards stakeholder or other category
Sector and interests	Known technical, industrial or research interests
Reason for selection	Why the result was considered relevant
Contact activity	Email, telephone call, meeting, event interaction or material supplied
Date and status	Date contacted and current follow-up position
Interaction	Response, meeting, download, referral, request or other engagement
Sentiment	Positive, interested but conditional, neutral, not currently relevant or negative
Requirements and barriers	Technical needs, cost concerns, timing, validation requirements, integration issues or funding constraints
Agreed next step	Follow-up, meeting, introduction, material requested or no further action
Responsible person	Insight Media contact and, following referral, relevant result owner
Handover status	Whether the record has been transferred to the result owner
Evidence of outcome	Training adoption, methodology use, pilot discussion, collaboration opportunity or other identifiable result

Sentiment notes should remain factual and concise. Contact information should be handled in accordance with applicable data-protection requirements, with access limited to those responsible for the relevant communication and exploitation activity.

9.6. Qualification and handover

Contacts are classified according to their level of engagement:

- **Aware:** relevant information delivered, but no response yet;
- **Engaged:** opened, responded to or interacted with the material;
- **Interested:** expressed a specific interest, question or potential use;



- **Qualified opportunity:** identified a credible use case, collaboration, trial, adoption or reuse opportunity;
- **Referred:** introduced to the relevant result owner or exploiter;
- **Ongoing:** discussion is continuing beyond the initial WP8 contact;
- **Not currently relevant:** no present opportunity, but retained where appropriate for future reference.

Each result owner will receive a database containing the contacts, interaction history, expressed interests, barriers, sentiment and agreed next steps relevant to its result. This does not commit the partner to pursue every contact. It provides an organised evidence base from which the partner can decide whether further engagement is appropriate and proportionate.

9.7. Evidence of outcomes

The activity is already generating identifiable outcomes, including:

- An Italian educational institution actively using FLASH-COMP training materials;
- Companies adopting or applying the 6Ps ZDM readiness process; and
- Active contact with several companies interested in exploring ZDM within their manufacturing processes.

These examples demonstrate the intended progression from communication to use:

Targeted communication → Engagement → Application or collaboration

→ Evidence of exploitation

Further outcomes have included requests for further information, meetings with result owners, use of training or assessment materials, participation in demonstrations, final event, possible inclusion in future proposals and continued contact regarding possible adoption.

9.8. Monitoring and evidence framework

The implementation of the targeted engagement strategy will be monitored at three levels, distinguishing the audience resource created, the engagement completed and the outcomes evidenced. Figures will be reported as of a defined cut-off date and only were supported by the segmented audience database or a recorded interaction.

Table 40. Monitoring levels for implementation of engagement strategy

Monitoring level	Indicators
Audience resource created	Stakeholder organisations and professional contacts identified; sectors and audience groups represented; contacts matched to individual KERs, ERs and URs; warm or previously engaged contacts identified; and result-specific audience records prepared for handover.
Engagement completed	Result-specific communications sent; responses received; information requested; meetings or discussions held; sentiment recorded; and contacts referred to the relevant result owner or exploiter.
Outcomes evidenced	Training or methodology adoption; publication or knowledge reuse; expressions of interest in pilots, validation or integration; new collaboration discussions; inclusion in proposals; and other identifiable follow-up activity linked to a FLASH-COMP result.



A result-level monitoring matrix has been developed and is being maintained using the following structure:

Table 41. Result-level engagement monitoring matrix

Result	Relevant contacts identified	Warm or engaged contacts	Contacted	Responses	Positive or conditional interest	Meetings or detailed discussions	Confirmed use or adoption	Referred to result owner	Next-step opportunities
Each FLASH-COMP KER, ER and UR	Recorded by result	Recorded by result	Recorded by result	Recorded by result	Recorded by result	Recorded by result	Recorded where applicable	Recorded by result	Brief description or count

Not every indicator applies equally to every result. Adoption and reuse are particularly relevant to training, methodologies and publications, while pilot, integration and licensing discussions are more relevant to the technical KERs and ERs. Blank fields are interpreted as zero unless the underlying records confirm that no activity occurred.

Contacts will be classified consistently as:

- **Matched:** the contact's known interests correspond to the result;
- **Warm or previously engaged:** relevant previous interaction is documented;
- **Contacted:** a result-specific communication has been sent;
- **Responsive:** the contact has replied or interacted;
- **Interested:** a specific interest, question or possible use has been identified;
- **Qualified opportunity:** a credible adoption, trial, reuse or collaboration pathway has been discussed;
- **Referred:** the contact has been introduced or transferred to the relevant result owner;
- **Confirmed outcome:** an identifiable use, adoption, collaboration or other follow-up activity is evidenced.

The populated matrix and associated contact records form part of the result-level handover to the responsible partners. This will provide both evidence of the targeted engagement undertaken by WP8 and a practical resource for any subsequent exploitation or continued-use activity.

The principal deliverable from this activity will therefore be more than a record of communication outputs. It will be a structured, result-specific engagement resource showing who was approached, why they were relevant, how they responded and what opportunity may exist for continued exploitation, collaboration or reuse – by the relevant partner/exploiter after the project ends.

10.CONCLUSION

FLASH-COMP has produced a portfolio of technical, methodological and knowledge-based results with different levels of maturity and different routes to impact. The task now, at the end of the research project's funding period, is therefore not simply to communicate that these outputs exist, but to give each result the best practicable opportunity to progress through the form of exploitation most appropriate to its purpose, ownership, readiness and market potential. ***The exploitation plans presented in this document provide just such a basis for that transition.***



For the KERs and commercially oriented ERs, the immediate post-project priority is for the responsible partners to assess which results justify follow-up activity and further investment. This decision should take account of technical maturity, validation evidence, ownership and access arrangements, market demand, strategic fit and the resources required to progress. Some results may support near-term licensing, service provision or integration into existing offerings, while others will require additional technical development, industrial validation or external funding. ***The plans therefore identify credible pathways and decision points rather than assuming that every result will proceed directly to market.***

Particular attention should now be given to the relationship between the individual technologies and the potential Combined DSS. MSI's generic Data Platform, INEGI's process knowledge and simulation capabilities, LORTEK's decision-support contributions, and the associated monitoring technologies can each support distinct exploitation pathways. Their integration could create a more complete decision-support offer for liquid resin infusion and composite manufacturing.

However, continued joint development after FLASH-COMP cannot be assumed. It would require a formal agreement between the relevant partners, a viable commercial or funded development opportunity, and clarity over the DSS architecture, ownership shares, exploitation leadership, revenue allocation, delivery responsibilities and ongoing support. INEGI has been identified as a possible lead exploiter because of its focus on composite manufacturing, while MSI and LORTEK would remain important technology providers. ***This proposed model, together with the possible role of MADE, should be explored and confirmed only if the partners decide that the opportunity is technically, commercially and financially viable.***

MSI's Data Platform and Data Augmentation Dynamics environment also provide routes beyond the initial FLASH-COMP application. The generic Data Platform could be adapted for other industrial sectors, including paper and steel, by combining it with the relevant process-specific data, models and applications. Data Augmentation Dynamics could support the creation of synthetic, process-specific data for AI development, simulation and validation. ***These opportunities can be pursued independently by MSI, subject to market demand, available resources, data rights and the requirements of each application.***

The remaining ERs and URs require equally purposeful, although not necessarily sales-led, exploitation. The testbed, demonstrators, sustainability and maturity methodology, training materials, standardisation work and scientific publications can support industrial services, workforce development, research activity, future projects, partner positioning and new collaborations. Much of this continued use can take place through partners' existing activities and does not necessarily depend on maintaining the full consortium.

Evidence of continued use could include testbed and demonstrator applications, organisations assessed through the POLIMI methodology, learners reached, training materials reused, standardisation actions pursued, publications accessed and cited, and follow-on proposals or collaborations arising from the work.

Some of that is already happening as the project comes to an end. Following lessons learned at the project's final industry event, held at AZIMUT's facilities in Avigliana a senior project consultant at ITS Sustainable Mobility Aerospace / Mechatronics Foundation will be using the FLASH-COMP training materials for the relevant training courses within the foundation.



Communication and dissemination will remain connected to exploitation outcomes for as long as relevant channels are maintained. Insight Media is committed to this activity and sees clear commercial opportunity for making this investment. Activities through partner channels, Projects Magazine, the 4ZDM cluster and cooperation with sister projects will continue to direct relevant audiences towards the results and create opportunities for adoption, reuse and collaboration. ***Where possible, their value will be assessed not only through reach or visibility, but through resulting enquiries, demonstrations, industry discussions, knowledge reuse, research cooperation and participation in subsequent projects.***

As the project closes, each responsible partner has a clear record of the status of its result, the ownership and access position, the proposed exploitation or continued-use route, and the outstanding requirements identified through this planning process.

Partners must subsequently decide which opportunities merit further development and what level of technical, commercial or financial commitment they are prepared to make. The result-level plans should serve as reference roadmaps that can be revisited where commercial demand, institutional priorities, collaboration opportunities or new funding provide a viable basis for action. Results involving several partners will require new or continuing agreements before joint exploitation can take place; the existence of this plan does not itself create an obligation to fund or undertake post-project development.

WP8 supports this transition by consolidating the available evidence, partner intentions, dependencies, decisions and outstanding requirements into a coherent exploitation record. Proportionate communication between relevant partners after project closure would help opportunities to be recognised and pursued, but continued coordination will depend on partner interest and available resources. ***Where immediate exploitation is not feasible, the results should remain sufficiently documented and accessible to support later commercial discussions, future research proposals and renewed collaboration.***

This outcome-focused approach meets the expectation that communication, dissemination and exploitation activity should contribute to what happens beyond the research itself.

Success should not be judged by an assumption that every plan will be implemented, but by whether FLASH-COMP leaves its results in a condition in which credible next steps are understood, ownership and dependencies are visible, potential users can assess their value, and partners are equipped to act when suitable market, collaboration or funding opportunities arise.

Where technologies advance towards industrial use, methodologies and knowledge are reused, or relationships established through FLASH-COMP lead to subsequent activity, the project will have achieved sustained impact beyond its funded lifetime.