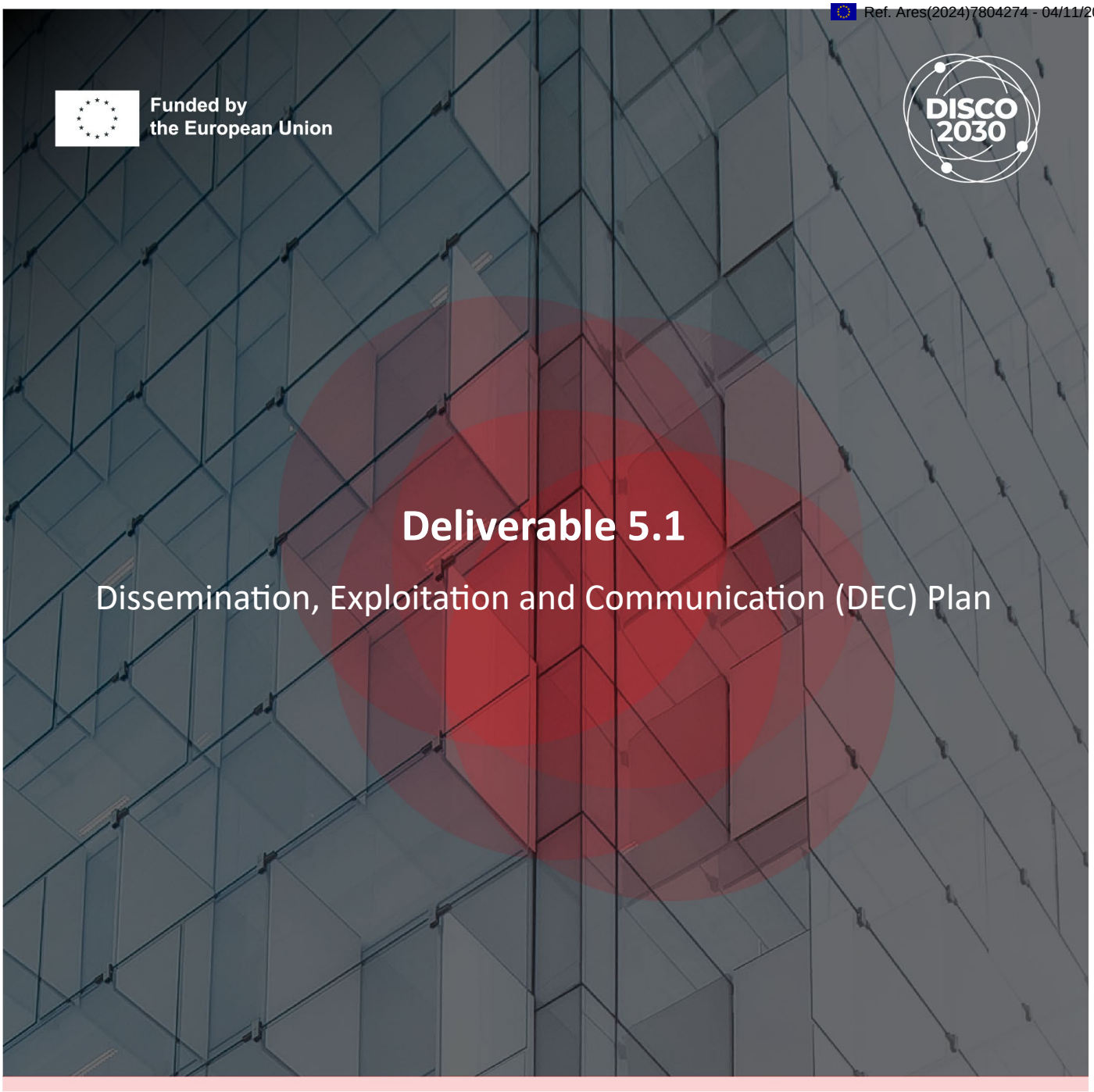

Deliverable 5.1

Dissemination, Exploitation and Communication (DEC) Plan

Project Acronym	DISCO2030
Project Full Title	Combining DISsimilar materials into functional large-scale and light-weight COmponents and structures
Call Identifier	HORIZON-CL4-2022-RESILIENCE-01
Type of Action	HORIZON-RIA
Start Date	1st of December 2022
End Date	30th of November 2025
Grant Agreement No	101091860

Funded by
the European Union

This project has received funding from the European Union's H2020 research and innovation programme. This flyer reflects only the author's view and that the European Commission is not responsible for any use that may be made of the information it contains.

WP5	Standardise, Disseminate, Exploit and Communicate
Due Date	June 30th 2024
Submission Date	June 30th 2024
Responsible Partner	EWF
Version	1
Status	Published
Author(s)	Diana Rodrigues
Reviewers(s)	TUM MAT
Deliverable Type	DEC – Website, patent filings, videos, etc
Dissemination Level	PU – Public

Revision	Date	Author/Organisation	Description
1st	14/06/2024	Diana Rodrigues	First Internal Draft
2nd	05/09/2024	Diana Rodrigues	Final Version
3rd	05/09/2024	Anja Drescher/TUM MAT	Proof-read

Statement of originality

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgment of previously published material and of the work of others has been made through appropriate citation, quotation, or both.

Table of Contents

Executive Summary

The Dissemination, Exploitation and Communication (DEC) Plan is a strategic document that will encompass both dissemination and exploitation plans. The work associated with the dissemination and exploitation of results will be implemented in WP5. The DEC Plan will make the link between the exploitation and the dissemination plans being both strongly driven by and towards the project results. Protection and “modus operandi” agreements will also play a big role in the DEC Plan as it will be a strong component of the business model of the DISCO2030 project and will allow for the freedom to operate of the individual partners as well as describing how they will engage and cooperate towards the full exploitation of the results.

The DEC Plan will have clear objectives - specific to the consortium, to the technology and to the target markets and will clearly define both how the research results will be implemented and how they will impact the market, on future developments and policy making. The initial DEC Plan will focus on the following:

- The needs that DISCO2030 responds to and how the project addresses these needs.
- What new knowledge (results) DISCO2030 will generate.
- Who the key stakeholders will be, both internally and externally to the DISCO2030 consortium.
- Quantification of the benefits delivered.
- How other stakeholders like scientific community, general public and policy makers will be informed about the generated results.

List of Figures

List of Tables

1. DISCO2030 briefly

The main motivation for scientists and industries around the globe to join multiple materials (including dissimilar materials) is achieving **multi-functionality**. For example, modern aerospace engines are multi-material devices, as they need to fulfil the function of being able to operate in harsh environments, and at the same time should be light enough to not negatively impact a plane's/spacecraft's payload (i.e., ability to carry weight).

The multi-functionality requirements of modern devices keep challenging researchers and industrial designers every day, often creating dilemmas of conflicting objectives – e.g., designing materials with high strength, that are at the same time extremely light or have a high thermal conductivity.

State-of-the-art multi-material joining techniques such as brazing, solid-state welding or mechanical joining force industrial designers to accept the process limitation of firstly machining the respective components (made of different materials), followed by joining with the respective technique in a second step. This process limitation leads to suboptimal results, as it significantly reduces the design freedom of multi-material devices and creates "dead spaces" in areas where two dissimilar materials are joined, thus negatively impacting the part's weight. It also does not offer a viable pathway towards achieving the "holy grail" of materials science – the so called "graded" materials. The latter are materials in which the composition changes continuously over the volume, resulting in locally optimized material properties to fulfil specific functions.

An emerging alternative to remedy the above-mentioned limitations and provide a viable pathway towards graded materials is **additive manufacturing (AM)**. AM offers a radically different approach to manufacturing by gradually depositing, joining, or solidifying materials to create 3-dimensional objects. Thanks to the high design freedom offered by current AM technologies a "form follows function" approach is made possible. However, the area in which AM is still in its infancy is dissimilar material joining. Whilst first successes have been demonstrated at lab scale, AM is not yet able to offer reliable dissimilar material joining solutions that are mature enough to be widely taken up by the industry.

Two important "families" of AM technologies have emerged in recent years: Powder-bed fusion (PBF) and Direct Energy Deposition (DED). PBF is a promising AM technology for printing highly complex geometry parts and components with comparatively high accuracy. Its main drawback are the limited dimensions of parts that can be manufactured. DED is a very versatile technology, capable of processing metals or polymers in the form of powder or wire as feedstock. The big advantage of DED is the technical possibility of *in situ* joining of multi-materials. Its main disadvantage is the lower design freedom and lower accuracy compared to PBF. Both technology families will be further developed in the DISCO2030 project to make dissimilar material components with a "form and property follow function" approach a reality.

The overall aim of the project is to develop and demonstrate (TRL 6) **two first-of-a-kind hybrid manufacturing methods for joining dissimilar metal-metal and metal-polymer materials**, to manufacture **lightweight**, **complex-geometry multifunctional devices that are at the same time able to operate in harsh environments** (rocket engines, marine engines, and hydrogen fuel tanks).

For the **metal-metal domain**, the DISCO2030 project will develop a hybrid manufacturing method based on a combination of PBF and powder-directed energy deposition with either laser beam or plasma arc as energy source (PDED/LB, P-DED/PA).

For the **metal-polymer domain**, the DISCO2030 project will develop a hybrid manufacturing method based on the combination of PBF, wire-directed energy deposition (W-DED) and polymer-directed energy deposition (POLDED).

The development of one hybrid manufacturing method for metal-metal dissimilar materials and another method for metal-polymer dissimilar materials is motivated by the radically different mechanical, thermal and chemical properties of metals and polymers, requiring different technological approaches. The special feature of metal-metal hybrid manufacturing is that the materials can form a direct material-to-material joint. For this purpose, different but related AM technology building blocks with different accuracy and cost structures will be examined in DISCO2030 and investigated for their suitability for multi-material applications.

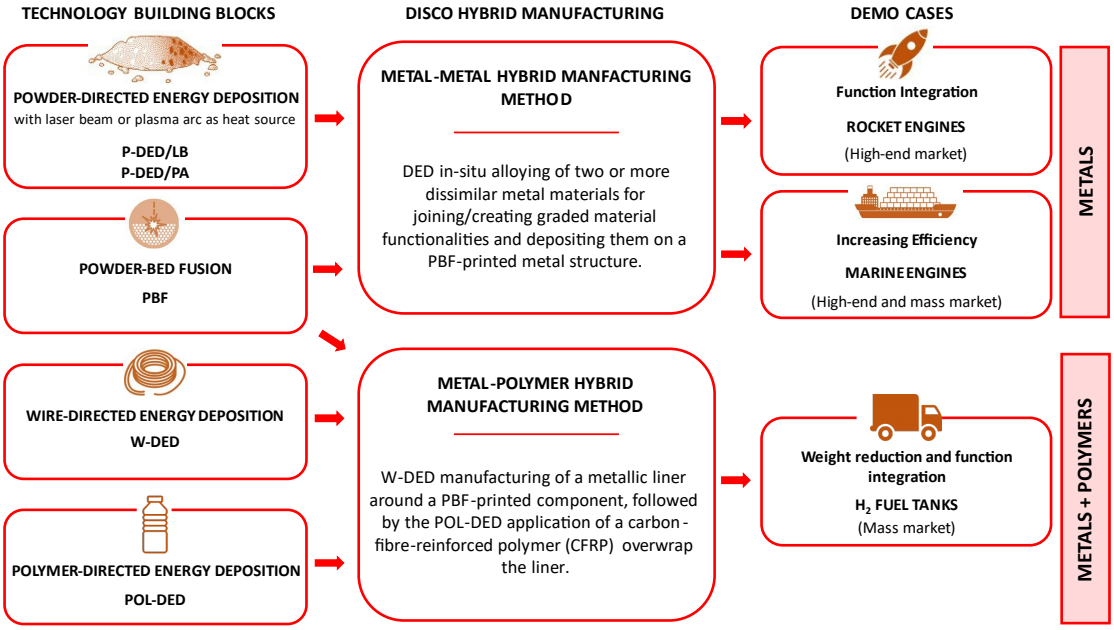

Figure 1 - DISCO2030 project at a glance.

The underlying vision is that within 5 to 8 years the novel combination of AM techniques developed in the DISCO2030 project will become a recognized and widely used manufacturing standard in various industries, replacing traditional methods such as die casting and mechanical assembly of multiple parts, making the EU's manufacturing sector more sustainable and efficient, but also increase its resilience by making it less reliant on non-EU supply chains (i.e., no need for sourcing hundreds of components from global supply chains) and more flexible in terms of responsive production (ability of AM to flexibly respond to rapidly changing demand for certain products).

2. Plan for Dissemination, Exploitation and Communication (DEC)

A first release of the **DEC plan was elaborated on March 31st 2023 (M3) and is now being updated,** as mentioned in Annex I of the Grant Agreement (Description of the action, DoA, Part A). All partners will contribute to the implementation of the DEC measures. The coordination and implementation of the communication measures will be led by EWF.

One of the important aspects to mention is the **Gender Impact Assessment**. Although the gender dimension is not relevant in the context of the proposal from the methodological point of view, DISCO2030 aims to actively include the gender dimension, especially in WP5 and the DEC plan. Special attention will be paid to include women, who are underrepresented in the sector, both on the project partner side and in the target audiences. Examples are the production and dissemination of explainer videos, interviews with potential customers, trade shows and workshops. Moreover, the measures from the Gender Equality Plan will be actively followed, e.g., during recruiting.

2.1. Contribution to Expected Outcomes and Impacts

To defend its position as a leader in manufacturing technologies, the EU needs to develop technologies that can be applied across various industries/sectors and ultimately deliver solutions to the key challenges faced by societies in Europe and globally. In order to be able to do so, the technology development process cannot happen in silos, but must be driven by interdisciplinary teams consisting of process experts, material experts, simulation experts and end-users, but also **communication experts able to amplify the key messages and bring them to target groups beyond scientific/industrial audiences**.

DISCO2030 will produce three tangible results to address this need:

Table 1 – DISCO2030 results and target groups to benefit.

DISCO2030 Results	Target Groups
R5.1 Dissemination, Exploitation and Communication Plan	Industry/Scientific community Policymakers Investors Standardisation bodies General public
R5.2 Business Plan	
R5.3 Documentation of novel dissimilar material testing procedures setting the basis for new standards	

The take-up of project results by the respective target groups is expected to lead to the following specific outcomes (medium-term) and impacts (long-term) post-project:

Table 2 - DISCO2030 contribution to expected outcomes and impacts.

	Outcome/Impact	Justification
OUTCOMES	*Dissemination of the challenges and benefits of functional multi-material components and structures in the relevant industrial sectors.*	A dedicated **Dissemination, Exploitation and Communication Plan (R5.1)** will be developed and refined throughout the project to reach key stakeholders, including stakeholders in the aerospace, marine and automotive sectors beyond the use-case partners Avio, Wärtsilä and Cryomotive. The plan will follow a multi-pronged strategy to reach various target groups via appropriate channels and with tailored messages.
	Strengthening of the EU's manufacturing industry through the intensive implementation of innovative and unconventional technologies along the EU's manufacturing value chain.	The **Business Plan (R5.2)** to be elaborated in the project will define a viable route to market for the innovative and unconventional hybrid manufacturing technologies developed in the project, centred around the partner Oerlikon being responsible for bringing the technologies to the market under a licensing-model with the research and university partners. The documentation of material testing procedures will be used as input for **novel standards (R5.3)**.
THE OUTCOMES WILL CONTRIBUTE TO THE FOLLOWING IMPACTS		
IMPACTS (LONG-TERM)	***Technological/economic impact**: creating more and better jobs.*	**Scale and significance:** It is expected that thanks to the uptake of the novel hybrid manufacturing methods the partner Oerlikon will be able to create approx. 20-25 jobs at its AM facility in Feldkirchen and Barleben (Germany), ultimately contributing to the EU policy objective of reindustrializing the EU.

		The technology start-up Cryomotive (hydrogen tank use-case) is expected to grow significantly and add approx. 10 full-time jobs to its team, should the DISCO2030 technology prove to be successful.
	Scientific: *Fostering diffusion of knowledge and open source.*	It is expected that thanks to the open access approach followed by the DISCO2030 project, new knowledge will be generated in adjacent disciplines, such as ceramics material research.

2.2. Targeted Audiences and Respective Objectives

There's a need to create an effective plan to ensure that results are disseminated to the relevant stakeholders. For that purpose, a database to register the technical and commercial interests of all stakeholders will be developed and cultivated throughout.

The **open science strategy** of DISCO2030 will be guided by the principle of making research results available free of charge as soon as possible in the process while ensuring the protection of sensitive financial data and intellectual property. The DISCO2030 open science strategy will be guided by **TUM's Open Access Policy** (adopted in 2014), which stipulates that "all research results of scientists at TUM are to be made freely accessible throughout the world and thus be rendered as visible as possible". Deliverable 6.1 regarding the **Data Management Plan** gathers all information regarding TUM's internal research data handling guidelines, but also orientate itself towards other guidelines such as the TUM Research Code of Conduct and the Open Access Policy. The plan will include detailed roadmaps on the planning, collection, processing, and publication of research data.

In support of this objective, the following practices will be integrated within the delivery of the proposed research programme:

i. DISCO2030 will facilitate **open access to all scientific publications** released by partners which draw on project research results via an open research repository MediaTUM hosted and managed by the coordinator TUM and via the Open Research Europe platform. To ensure 'early and open sharing,' the DISCO2030 research plan relating to the use of selected data sets, will be published in several public repositories, including Open Research Europe and OSF and AsPredicted. Research articles focusing on the hybrid manufacturing method development approach to be established in DISCO2030 will be published in two stages, i.e., pre-research, and post-research, and subject to peer-review. Similarly, all academic partners will be encouraged to release preprints of their scientific manuscripts.

ii. DISCO2030 will ensure the responsible management of **research data in line with FAIR principles**.

iii. DISCO2030 will ensure the reproducibility by providing **external stakeholders** with access to all information and research outputs, tools, and instruments to validate the conclusions of scientific publications or to validate/re-use research data.

iv. DISCO2030 will facilitate the active participation of **technology end-users**, i.e., Avio, Cryomotive and Wärtsilä. This is done to generate more relevant outcomes, including commercial uptake post-project.

Besides technical stakeholders, open science efforts (as captured by the Communication Plan) will also aim at addressing **citizen science**, i.e., bring some of the technical topics behind DISCO2030 closer to non-expert audiences in Europe (via website and explainer video).

A DEC plan has already been developed for the DISCO2030 Project and is based around four key objectives. Each objective is accompanied by specific measures and appropriate KPIs. The target audience of these measures are listed and further clarified below:

- **Scientific and Academic Community:**

These stakeholders, international researchers of all levels active in the fields of innovative production technologies, AM, and material sciences, can provide opportunities to establish linkages with other R&I projects and will exploit the future research outputs – via the TUM open access platform – to enable new scientific breakthroughs in their respective fields.

Key message:

"DISCO2030 will deliver new scientific breakthroughs regarding how advanced AM technologies such as PBF and DED can be leveraged to realise highly efficient and productive AM hybrid manufacturing strategies for joining dissimilar materials."

- **AM Industry:**

These stakeholders are expected to procure and deploy the DISCO2030 technologies within their existing and future manufacturing lines post-project. This target group comprises Direct & Indirect Technology end-users, including European & international AM Manufacturers & their suppliers and relevant European and national trade associations, e.g., European Additive Manufacturing Group (EuroAM), European Factories of the Future Research Association (EFFRA), Clean Hydrogen Partnership, VDMA, etc.

Key message:

"DISCO2030 is a game-changing manufacturing process that technology companies can deploy to support the cost-effective production of highly complex parts, whilst minimising environmental impact."

- **Industrial end-users:**

In this group OEMs and their suppliers in the aerospace, marine and automotive sectors are targeted, but also energy, consumer goods and health markets. This group also includes workers and labour unions active in the respective sectors. These stakeholders will use the multi-material components/structures manufactured with DISCO2030 technologies.

It is important to understand that workers employed particularly at supplies of parts which may be replaced by AM may be concerned about the rise of AM.

Key messages:

"DISCO2030 is a pivotal and enabling manufacturing process that can directly contribute to solving the European industry's key challenges, such as the decarbonization in transport challenge."

"The widespread deployment of AM is an opportunity rather than a threat, helping to create new high-skilled jobs in Europe after years of manufacturing jobs being lost to other parts of the globe. AM ultimately contributes to the EU's reindustrialisation policy."

- **Regulators and Standard Bodies:**

European AM Standard Bodies, e.g., CEN, DIN, EN, ISO, ASTM committees, and more are stakeholders that directly create and shape the legal framework and standardisation norms that will govern the future use of PBF and DED-based AM processes, and the certification procedures of the products that will be manufactured through this process.

Key message:

"DISCO2030 is one of the forerunners when it comes to bringing novel technologies for dissimilar material joining into industrial maturity and directly contributes to the EU's Green Deal priorities, whilst paving the way for new standards in the area of dissimilar material testing."

- **General Public:**

Mainly represented by non-expert EU citizens with an active interest in advanced technology and manufacturing topics, or R&I investments made through the Horizon Europe programme. As taxpayers these stakeholders should be regarded as indirect investors in the DISCO2030 results. Partners are committed to evidencing that this investment presents excellent value for money.

Key message:

"DISCO2030 is an EU-funded R&I project that will deliver novel AM technologies that enable the green and commercially viable production of high-tech products by large and small European manufacturers."

2.3. DEC Measures and KPIs

Communications will be undertaken throughout the duration of the project. In addition to communicating knowledge and results to potential end-users, it is also intended to share all the publicly communicable deliverables within the scientific and academic communities related to the end-users.

The communication strategies have been designed to ensure that the commercial impact of the project is enhanced. In the previous section, the targeted audiences, and stakeholders that the DISCO2030 project will approach were described. During the project implementation, different DISCO2030 messages to specific audiences will be conveyed and several types of technical and market information will be delivered to different types of stakeholders accordingly.

In the following sections is an overview of the proposed measures, some of which have already been achieved or are currently being developed.

2.3.1. Dissemination Measures and KPIs

Dissemination activities will be led by TUM MAT according to the open science practice. They will encompass, among others, presentations at 10 scientific conferences, journal publications and anonymised sharing of selected non-commercially sensitive data with the scientific community.

Table 3 – Initial Dissemination measures for DISCO2030.

Objective 01: To generate strong pre-market interest for the novel hybrid manufacturing process resulting from the DISCO2030 project among target customers and end-users, hereby facilitating the accelerated and wide adoption of the key technologies within the European manufacturing industry post-project.		
D1.1	**D1.2**	**D1.3**
Exhibit the DISCO2030 technologies at **5 international trade shows**, including: Formnext, RapidTech, 3D Printing, Advanced Manufacturing Technology Conference AMTC organized by Oerlikon.	Position articles about the DISCO2030 technologies in **5 publications**, including: TCT Magazine, All3DP, 3D Metal Printing Magazine, etc.	Organise **2-3 information/open day events** involving 20-25 target customers at the Oerlikon and/or TUM facility to showcase the demonstrator hybrid manufacturing production line.

Objective 02: Key research outputs resulting from the DISCO2030 project are optimally exploited by the wider European scientific and academic community, hereby catalysing new scientific breakthroughs in diverse fields linked to dissimilar material joining.			
D2.1	**D2.2**	**D2.3**	**D2.4**
Research outputs will be made available via **TUM open access data depository**, in compliance with FAIR principles.	Research outputs will be used to inform the publication of **5 academic papers** in the following international research journals: Additive Manufacturing, Metals, Advanced Optical Technologies, IEEE Transactions on Industrial Informatics.	Research outputs will be presented at **10 international academic conferences**, including: SFF Solid Freeform Fabrication Symposium, ICALEO, SWISSMEM Industry Day.	Organise **2-3 interactive workshops at TUM facilities** with representatives of 2-3 recent or current EU R&I projects focusing on dissimilar material joining to facilitate exchange of learnings and identify possible synergies.
Objective 03: Ensure a robust regulatory framework that creates the market conditions for the expanded use of dissimilar material joining technologies, whilst maintaining the highest standards of safety, quality, and user trust.			
D3.1		**D3.2**	
Research outputs will be presented to national and EU policy makers and standardisation bodies at technical working group/committee meetings, including the industry working groups **CEN/TC 438 - Additive Manufacturing**.		Research outputs will be presented at regulatory themed sessions during the **ASTM ICAM conference in 2025**.	

2.3.2. Exploitation Measures and KPIs

An overall exploitation plan will be composed by EWF based on IP defined in the next sections and further fine-tuned during consortium agreement negotiations with the assistance of all partners. The draft plan (including the DISCO2030 business case) will evolve with the project implementation until a final version is obtained to be further incorporated in the DEC Plan.

Table 4 - Exploitation measures for DISCO2030.

Objective 01: To generate strong pre-market interest for the novel hybrid manufacturing process resulting from the DISCO2030 project among target customers and end-users, hereby facilitating the accelerated and wide adoption of the key technologies within the European manufacturing industry post-project.		
E1.1	**E1.2**	**E1.3**
Define strategy for securing appropriate **IP protection** for novel technology outputs, i.e., patents, soon after project completion.	Validate **pricing strategy for commercializing technology** through willingness-to-pay (WTP) interviews with 10 to 15 target customers.	Prepare a **business plan** for commercializing major technology IP post-project.
Objective 02: Key research outputs resulting from the DISCO2030 project are optimally exploited by the wider European scientific and academic community, hereby catalysing new scientific breakthroughs in diverse fields linked to dissimilar material joining.		
E2.1	**E2.2**	**E2.3**
Research outputs will be utilized to support R&I activities in **2 to 4 national and EU projects** running in parallel to the DISCO2030 project (including cross-fertilisation with 2 other projects being	Partners will establish **2 to 3 new Ph.D. positions during the project period**.	The usecases and insights gained from the project will be used to **illustrate industrial applications of PBF/DED in Master level courses**.

selected as part of the same topic).		
Objective 03: Ensure robust regulatory framework that creates the market conditions for the expanded use of dissimilar material joining technologies, whilst maintaining the highest standards of safety, quality, and user trust.		
E3.1		
The consortium will respond to **relevant EU public consultations on policy matters** that stand to influence the future adoption or use of AM dissimilar material joining technologies, using the DISCO2030 project results as proof-points.		

2.3.3. Communication Measures and KPIs

The communication activities will be led by the partner EWF. Some of the examples of communication activities will include the building of a project website, a social media campaign, and an explainer video for non-expert audiences (i.e., citizen science).

Table 5 - Initial Communication measures for DISCO2030.

Objective 01: To generate strong pre-market interest for the novel hybrid manufacturing process resulting from the DISCO2030 project among target customers and end-users, hereby facilitating the accelerated and wide adoption of the key technologies within the European manufacturing industry post-project.				
C1.1	**C1.2**	**C1.3**	**C1.4**	**C1.5**
Set up a **plan for targeting companies from primary target sectors** such as aerospace, marine and automotive, followed by secondary targets such as the energy and health/consumer goods industries.	Produce an **explainer video** describing benefits of innovative technology for end-users and communicate this via project and partner social media accounts to secure ~2,000 views.	Produce an **infographic** summarising the main benefits of innovative technology for end-users and disseminate via project and partner social media accounts to secure ~2,000 views.	**Present non-confidential results of use-case demonstration on project website**, highlighting the direct business benefits that were accrued by end-users, and share publication through project and partner social media accounts to reach ~2,000 views.	Facilitate **information exchange with 2 sister EU projects** (e.g., the MULTI-FUN project), which are in close relation to DISCO2030.
Objective 02: Key research outputs resulting from the DISCO2030 project are optimally exploited by the wider European scientific and academic community, hereby catalyzing new scientific breakthroughs in diverse fields linked to dissimilar material joining.				
C2.1	**C2.2**	**C2.3**	**C2.4**	
Provide information for accessing research results on project website.	Flag and amplify partner research papers or conference attendance relevant to DISCO2030 project via project website and social media accounts.	Promoting results at **scientific conferences**, **symposia**, in **EWF Newsletter**, and in **press releases**.	**Liaise with EU partnerships** such as EFFRA and Clean Hydrogen Partnership for future research and innovation topics and programmes.	
Objective 04: Maximize visibility of project activities to non-technical audiences and communicate how project results achieved with the support of EU grant funding will contribute to innovative technology solution that effectively addresses major societal challenges.				
C4.1	**C4.2**	**C4.3**	**C4.4**	
Create and maintain a dedicated **project**	Create and maintain dedicated **social media**	Produce an **explainer video** setting out	Publish quarterly online **newsletter**,	

website, hosting information about the R&I activities, key objectives and outputs, information about the research partners, and providing information about relevant dissemination and exploitation events. Target is to **secure 150 views per month**.	**accounts – LinkedIn** – for amplifying relevant organic and third-party online content. Target is to **secure +200 followers**.	project goals, and how results can address wider societal challenges. Target is to **secure +500 views**.	providing updates on project progress, highlighting key achievements, and promoting forthcoming public events. Target is to have a **readership of +200 subscribers by project end**.

3. Business Case and Exploitation Strategy

The exploitation plan in collaboration with the dissemination and communication activities will engage end-users and potential customers as well as scientific communities for the efficient market uptake of the results and additional R&D activities. It will convey value to interested parties, design detailed plans for each result, define IP ownership and protection intentions from each prospective owner, and set up an appropriate innovation management.

3.1. Business Case

Projects require an investment of not just money, but in time and effort, thus, the key question a business case must answer is: is this project worth it? A business case is at the heart of any project and outlines the justification for undertaking the project. It is intended to convince key decision-makers of the merits of a particular course of action by describing the benefits, costs, and impact, plus a calculation of the financial case.

Basically, it contains the reasons for the project, the options available, the benefits of options, the cost evaluation, the timescales, and risk assessment. It can also be used to determine how the success of the project or investment will be measured to be able to ensure that any promised improvements can and will be delivered.

3.1.1. Target Market and Market Entry Strategy

The DISCO2030 hybrid manufacturing processes will enter two primary target markets post-project: the market for **newbuilt specialised components/structures** operating in harsh environments and the market for **repair services for machinery/equipment**. Whilst the newbuilt component/structure target market will basically constitute a continuation of the activities within the project, the partners have identified a large commercial potential in the repair services market. The unique DISCO2030 DED-based hybrid manufacturing methods open completely new possibilities of repairing components/parts, which today have to be replaced in their entirety whenever they reach their wear & tear. An example are die-casted pistons in marine and energy generation engines, whose useful life may be prolonged by applying a dissimilar material via the DISCO2030 hybrid manufacturing method. The EU's machinery and equipment repair services market (across different sectors) employed over 1 million people across the EU and had a turnover of 160 billion EUR in 2018, according to Eurostat.

The specific industrial sectors to be targeted primarily in both, the newbuilt part market and the repair service market, include aerospace, marine and the truck/logistics markets, followed by adjacent sectors such as power generation, renewable energies, oil & gas, and rail applications,

but also the healthcare sector (in the mid- to long-term). The primary focus on aerospace, marine and trucks is motivated by the experiences to be gathered in the project, with the technology partners being able to point to the lighthouse demos achieved in the project and thus attract a wider customer base. Adjacent markets such as power generation or renewable energies will be targeted either via **Oerlikon**'s existing commercial relations in those markets or via the use-case partners.

For example, the partner **Wärtsilä** has a strong footprint in power generation and renewable energies. Due to the technical similarities of marine engines and some of Wärtsilä's power generation products the replication potential of DISCO2030 into the power generation market is significant. Increased product performance resulting from DISCO2030 is estimated to improve Wärtsilä's revenues against a counterfactual scenario by 200k EUR per year.

The unique capability to combine materials that will be developed as part of DISCO2030 has potential to be an enabler for increased performance for several applications including rocket nozzles and heat exchangers which will be explored in the project. This combination of materials and AM processes will have a broad appeal with opportunities beyond the focus applications and thus Oerlikon estimates an increase in revenue in the order of 1,000k EUR per year. The applications developed in this project are expected to drive the initial production ramp-up, which is an additional key benefit compared with the situation without the project.

The innovative manufacturing method to be developed through the DISCO2030 project will enable **Avio** to reduce the manufacturing time to realize a combustion chamber. An increase of production rate is expected with a consequent revenue related to the product equal to 1,350k EUR per year (about two more combustion chambers per year). Moreover, the possibility to realize such kind of combustion chambers, thanks to the innovative DISCO2030 technology, will allow Avio to decrease the recurring costs, make the development of new launchers more affordable and so attract new clients.

The hybrid metal-polymer manufacturing methods developed during the DISCO2030 project would lead to a higher level of integration at **Cryomotive**'s hydrogen pressure vessel. This contains the integration of heat-exchanger structures, the implementation of a more load-compliant design and the introduction of alternative CFC matrix systems for insulation. Due to this increased product performance, Cryomotive's improved revenue against the described scenario can be quantified with 500k EUR per year depending on the production ramp-up.

The commercial potential between all primarily targeted sectors is remarkable, too. Regarding newbuilt components for trucks, the EU sector for manufacturing motor vehicles, including trailers and semi-trailers achieved a turnover of over 1 trillion EUR in 2018, according to Eurostat. This figure includes passenger cars, which will not be targeted by DISCO2030 (also due to a strong drive towards electricity in passenger vehicles) and other road vehicle types such as motorcycles, but nevertheless indicates the notable market potential. The aerospace parts manufacturing market is also significant. It is currently growing at a CAGR of 4% and is expected to reach 1,1 EUR billion by 2030. Particularly the EU countries France and Germany are dominating the market, accounting for a share of over 60% together with the USA. Finally, the marine engine market is also expected to grow. The market is being dominated by EU companies and is expected to move from 9,5 billion EUR in 2020 to approx. 13,2 billion EUR by 2027, at a CAGR of 4,7%.

The partners envisage to target the newbuilt component market in aerospace, marine and trucks in the first place, followed by the extension of their footprint into the repair market within these

sectors. Afterwards, the adjacent markets such as power generation, renewable energies or rail will be targeted.

In the table below the key needs of users and customers and the unique selling points (USPs) offered by DISCO2030 are in detail:

Table 6 - Overview of key customer and user needs and the DISCO2030 USPs.

		Needs	DISCO2030 USPs
CUSTOMERS	Aerospace, marine, and automotive OEMs.	Novel manufacturing method for joining dissimilar materials to design next generation products/ components.	Completely new dissimilar material joining approach based on AM, ultimately outperforming existing material joining techniques that create "dead spaces" and in most cases require joining of tens of hundreds of parts.
		Novel repair solutions.	A unique novel approach on repairing parts/components by applying a dissimilar material on the part.
		A manufacturing/repair method that is commercially competitive and meets the strict certification requirements in the respective industry.	A radically simplified approach to certification due to the existence of 1-3 components rather than hundreds of components that need to be certified, which translates into lower certification costs. The commercial competitiveness of DISCO2030 will be ensured by radically simplifying the procurement process, as the entire component/structure will be manufactured at only one supplier.
USERS	Aerospace, marine and automotive designers and engineers.	"Path-dependency" of the industrial designers and engineers on the characteristics of components/parts made available by suppliers.	Individual approach to every part/component, giving designers/ engineers almost unlimited freedom to develop a particular component/ structure.
	Supply chain managers.	A simplified process of procuring the components/structures, requiring the supply manager to interact with one partner rather than hundreds of suppliers.	No need to source hundreds of components/parts from multiple supply chains across the globe/increased resilience of EU industry.

3.1.2. Business Model

Given the purely business-to-business (B2B) focus of the technology, a business model based on servitisation is planned for the DISCO2030 hybrid manufacturing process (i.e., the partners do not plan to target any consumer products due to the lacking experiences with this market). Consequently, interested alpha customers from the aerospace, marine and automotive industries will be interacting with **Oerlikon as the commercialisation partner** and purchasing the service for manufacturing/repairing specific components/structures using DISCO2030. To ensure matching demand, the partner Oerlikon Metco (currently based in Switzerland) plans to open a

facility in either Germany or Italy. The decision to do so has already been taken independently of the EU project. The exact location within one of the two targeted EU countries is still pending.

Oerlikon envisages to close license agreements for the individual DISCO2030 project results/technologies with the research partners owning them, i.e., **TUM (POL-DED, P-DED/PA)** and **LKR (W-DED, including sensorization)**. First commercial details are captured by the Consortium Agreement, followed by stand-alone license agreements to be signed towards the end of the EU project.

As explained in Table 4 regarding the Initial Exploitation Measures for the project, to generate a strong pre-market interest for the novel hybrid manufacturing process resulting from the DISCO2030 project among target customers and end-users, hereby facilitating the accelerated and wide adoption of the key technologies within the European manufacturing industry post-project, one of the Exploitation Results to be achieved is the preparation of a **Business Plan** for commercializing major technology IP post-project (E1.3). For that, and with the support of every partner of the DISCO2030 consortium, a **Business Plan** was prepared to assess the initial business of the project based on the Business Model CANVAS, portrayed below. The detailed Business Model can be found in 4.2 Annex C.

Table 7 – DISCO2030 Business Model Canvas overview

Key Partners	Key Activities	Value Propositions	Costumer Relationships	Costumer Segments
- Who are our key partners? Project Partners and Industry Stakeholders, Internal Entities, Funding and support organizations **- Who are our key suppliers?** Raw material suppliers, Machinery and equipment suppliers **- Which key resources are we acquiring from partners?** Technical Expertise and innovation, funding and financial support, market insights and customer requirements **- Which key activities do partners perform?** R&D, Market	**- What key activities do our value propositions require?** Research and Development (R&D), Production Optimization, Certification and Compliance, Market Development, Cost Management **- Our distribution channels.** Direct Sales, Partnerships and Alliances, Online and Digital Platforms **- Customer relationships?** Key Account Management, Customer Support and Services, Engagement through Demonstrations **- Revenue streams?** Product Sales, Service Contracts,	**- What value do we deliver to the customer?** Innovation in Manufacturing, Cost Efficiency, Customization and Flexibility, Environmental Sustainability **- Which one of our customer's problems are we helping to solve? Complex** Manufacturing Challenges, High Production Costs, Extended Lead Times, Sustainability Goals **- What bundles of products and services are we offering to each Customer Segment?** 1. Space Industry: Multi-material combustion chambers and other	**- What type of relationship does each of our Customer Segment expect us to establish and maintain with them?** Key Account Management, Technical Collaboration support teams, long-term partnerships, customized solutions, Responsive training, Regulatory support, educational outreach **- Which ones have we established?** Dedicated account management, Project-based collaboration, technical support teams, service contracts, cross-selling and upselling **- How are they**	**- For whom are we creating value?** Space Industry, Aerospace and Defence, Thermal Management Systems, Hydrogen Storage and Transportation, Industrial Manufacturing **- Who are our most important customers?** Private and Governmental Space Organizations, Aerospace and Defence Contractors, Industries Requiring Advanced Thermal Management, Emerging Hydrogen Economy Players, High-tech Manufacturing Firms

Development and Customer Engagement, Regulatory and Certification Support	Licensing and Technology Transfer, Funding and Grants	high performance rocket engine components; Support services including maintenance, customization, and optimization of manufacturing processes. 2. Thermal Management Systems (Various Industries): Integrated heat exchanger assemblies for aerospace, marine, semiconductor, and industrial applications; Consultation and design services to tailor thermal management solutions to specific customer needs. 3. Hydrogen Storage Applications: Components and assemblies designed for hydrogen transportation and storage infrastructure: Engineering support to ensure compatibility and performance in hydrogen storage solutions. **- Which customer needs are we satisfying?** Performance and Reliability, Cost Reduction and Efficiency, Innovation and Advancement, Environmental and Sustainability Goals	**integrated with the rest of our business model?** Close Alignment with R&D, Customer Feedback Loop, Market education **- How costly are they?** Moderate to High cost	
	Key Resources		**Channels**	
	- What Key Resources do our Value Proposition require? PBF-LB/M and PDED-LB Systems, R&D Facilities, Engineers and Technicians, R&D Specialists, Metal Powders, Supply Chain Relationships, Investment Capital, Operational Budget, Patents and Trademarks, Innovation pipeline **- Our Distribution Channels?** Distribution Network, Warehousing, Sales Representatives, Marketing, Ecommerce and Online Presence, Customer Relationship Management (CRM) Systems Resources **- Customer Relationships?** Support Teams, Service Centres, Direct Contact Points, Feedback Mechanisms, Joint Development Projects, Technical Workshops and Training **-Revenue Streams?**		**- Through which Channels do our Customer Segments want to be reached?** key account management, industry events, technical collaborations, Digital platforms for product information, technical support teams, trade shows, Collaborative projects, regulatory support channels, and educational outreach through industry forums **- How are we reaching them now?** Participation in trade shows, conferences, and exhibitions to showcase technologies and network with potential customers, Company website, online product catalogues, and digital marketing campaigns, Joint development initiatives with strategic partners and customers **- How are our Channels**	

	Sales Teams, Distribution Network, Billing and Invoicing, Financial Analytics, Product Portfolio, Service Contracts		**integrated?** CRM Systems, Unified Communication, customer feedback **- Which ones work best?** Direct Sales and Key Account Management, industry events, collaborative projects **- Which ones are most cost-efficient?** Digital platforms, customer support teams, service contracts **- How are we integrating them with customer routines?** Communication, maintenance and support, online portals, feedback mechanisms	

Cost Structure	Revenue Streams
- What are the most important costs inherent in our business model? R&D costs, advanced manufacturing-equipment, raw materials, specialized workforce, customer support, sales & marketing. **- Which Key Resources are the most expensive?** Advanced manufacturing technologies, skilled workforce, raw materials and IP **- Which Key Activities are the most expensive?** R&D, production and manufacturing, sales & marketing, customer support & services, regulatory compliance	**- For what value are our customers really willing to pay?** Innovation and High Performance, Cost Efficiency, Customization and Flexibility, Reliability and Durability, sustainability **- For what do they currently pay?** Project based results, Service Contracts, Milestone Payments, Direct Purchases

3.1.3. Competitive Landscape

Understanding the competitive landscape is important for two main reasons: Firstly, it can help the project to identify potential threats and opportunities; Secondly, it can help the project to develop strategies to compete effectively. Throughout the project, a detailed analysis of this landscape will be carried out and updated according to European and non-European developments and data in the technological field of the DISCO2030 project.

DISCO2030 competitive landscape can be divided into direct and indirect competitors. The direct competitors of the DISCO2030 hybrid manufacturing methods are other dissimilar material joining techniques such as brazing, adhesive bonding, fusion and solid-state welding, and AM-based techniques to emerge in the near future as commercial technologies (e.g., PBF printing

coupled with cold-gas-spraying). Companies such as **Toolcraft**, **Fit AG** or **BEAMIT** can be seen as direct competitors in this market space. DISCO2030 will also be competing indirectly with manufacturing methods that may not be focused on dissimilar material joining but continue to play a significant role in the industry. Examples include traditional manufacturing methods such as die casting and mechanical joining of individual parts using bolts, screws, rivets. In the latter case, DISCO2030 customers may at the same time be competitors since many of the OEMs assemble their products in-house.

3.2. Exploitation Strategy

The exploitation assessment will support the DISCO2030 project partners in taking the necessary steps to fully exploit the outcomes of the project and benefit from them. The exploitation plans will have clear objectives, related to the consortium needs and requirements, on how the different technologies will be implemented and how they will impact the different market sectors. Moreover, there will be a close engagement between the project with policy makers, standardization bodies and the different industrial sectors that fit in the scope of the project. This will allow for a faster and smoother implementation of project outcomes in real industrial scenarios and having a higher impact on a competitive and demanding field, worldwide.

The exploitation strategy for DISCO2030 outlines a comprehensive plan to leverage advanced manufacturing technologies to meet critical industry needs and position DISCO2030 as a leader in the field.

Needs Addressed by DISCO2030 (Problems)

DISCO2030 responds to several critical needs across various high-tech industries:

- Complex Manufacturing Challenges: The difficulty in joining different materials to create integrated high-performance components.
- High Production Costs: Traditional manufacturing methods are costly and inefficient.
- Extended Lead Times: Conventional manufacturing processes have long lead times, which do not meet the fast-paced project deadlines.
- Sustainability Goals: There is an increasing need for more sustainable manufacturing practices to align with environmental regulations and customer preferences.

DISCO2030 responds to key challenges in high-tech manufacturing, including the difficulty of integrating different materials, high production costs, long lead times, and the need for sustainable practices.

How DISCO2030 Addresses These Needs (Solutions)

- DISCO2030 tackles these problems with advanced manufacturing technologies:
- Multi-material Additive Manufacturing: This technology enables the production of complex, multifunctional parts with fewer manufacturing steps, reducing material usage and production costs.
- Process Optimization: Enhanced production processes that are faster and more cost-efficient.
- Sustainability Focus: Manufacturing methods that lower energy consumption and material waste, contributing to greener production practices.

DISCO2030 employs multi-material additive manufacturing to produce complex, multifunctional components efficiently. This approach reduces material use, lowers costs, and accelerates

production timelines, while also focusing on sustainability by minimizing energy consumption and waste.

Competition

Several other entities are addressing similar needs:

- Traditional Manufacturers: Using conventional methods which are often less efficient and more costly.
- Other Additive Manufacturing Companies: Offering similar technologies but may lack the specialized expertise or comprehensive approach of DISCO2030.

While traditional manufacturers and other additive manufacturing companies address similar needs, DISCO2030 distinguishes itself through its technical expertise, integrated solutions, and strong environmental focus. The consortium's advanced R&D capabilities and process optimization make DISCO2030's solutions superior in terms of efficiency, cost-effectiveness, and sustainability.

Performance Comparison

DISCO2030's solution is superior due to:

- Technical Expertise: Leveraging advanced R&D capabilities from universities and research institutions.
- Integrated Solutions: Combining multi-material additive manufacturing with specialized process optimization.
- Sustainability: A strong focus on reducing environmental impact while maintaining high performance.

Innovation Brought by DISCO2030

- Advanced Multi-material Manufacturing: Unique ability to create integrated high-performance parts using multiple materials.
- Process Efficiency: Significant reduction in production steps and material usage.
- Environmental Benefits: Greener production processes that align with modern sustainability standards.

DISCO2030 introduces significant innovations, such as advanced multi-material manufacturing and highly efficient production processes. These innovations not only enhance performance but also contribute to greener production methods.

Internal Exploration by the Consortium (Evolution)

Internally, DISCO2030 will evolve through:

- Ongoing R&D Projects: Continuously refining and optimizing additive manufacturing techniques.
- Production Integration: Embedding advanced manufacturing technologies into existing production lines to enhance efficiency.
- Skill Development: Investing in training and development programmes for the workforce to stay at the forefront of technological advancements.

External Exploration by the Consortium (Business)

Externally, the consortium will explore DISCO2030 through:

- Direct Sales and Partnerships: Engaging with key customers in targeted industries through established sales networks and strategic partnerships.
- Market Development Activities: Showcasing demonstrator prototypes at industry events to generate interest and validate new technologies.
- Collaborations: Working with universities, research institutions, and industry stakeholders to co-develop and market new solutions.

Internally, the consortium will continue to evolve DISCO2030 through ongoing R&D, integrating advanced technologies into production lines, and developing workforce skills. Externally, the strategy involves engaging in direct sales, forming strategic partnerships, showcasing technologies at industry events, and collaborating with academic and industry stakeholders.

Beneficiaries of DISCO2030 (Sharing)

Beyond the consortium, other beneficiaries include:

- High-tech Manufacturing Firms: Access to innovative manufacturing solutions that reduce costs and enhance product performance.
- Environmental Advocates: Supporting corporate sustainability initiatives through reduced material usage and lower carbon footprint.
- Regulatory Bodies: Alignment with industry standards and environmental regulations.

Next Steps for DISCO2030 (Future)

To further advance DISCO2030:

- Expand R&D Efforts: Increase investment in research to discover new materials and refine manufacturing processes.
- Market Penetration: Strengthen market presence through targeted marketing campaigns and strategic partnerships.
- Customer Feedback Integration: Continuously improve products and processes based on customer feedback.
- Scalable Production: Develop scalable production techniques to accommodate increasing demand while maintaining efficiency and quality.

Beyond the consortium, high-tech manufacturing firms, environmental advocates, and regulatory bodies will benefit from DISCO2030's innovations. The next steps include expanding R&D efforts, increasing market presence, integrating customer feedback, and developing scalable production techniques to meet growing demand.

3.2.1. Partners Individual Exploitation Plans

The exploitation and dissemination of the results are assessed on the DEC Plan of the DISCO2030 results both during the project and post-project. To centralize and analyse the individual exploitation plans of each partner, EWF circulated a **Partner Exploitation Questionnaire** (Annex A) which covers, in more detail:

- **The Market Analysis:** Target market size, needs, trends and segments, competitive strategy, end-user requirements and benefits.
- **The Funding Requirements:** Funding needs post-project, potential sources of funds,

investment required and strategy for acquiring it.

- **The Commercialization Plan:** DISCO2030 will move the technology towards TRL 9 (system prototype demonstration in operational environment). A post-project plan on how to commercialize the project results will be included to include a set-up of a well-functioning manufacturing value chain.
- **The Financial Projections:** P&L accounts/forecasts, cash flow projections.
- **The Post-project Structure:** How DISCO2030 partners will work, definitions of products and services that will be offered, long-term aims and objectives of the partnership, SWOT analysis of the partnership and PEST analysis. The external environment analysis of a project, where innovative and research activities take place, is a necessary step towards successful exploitation. Through the **SWOT** and **PEST** analysis, the partners of a project will get access to necessary information to properly design the commercialization strategy of their key exploitable results. Specifically, with **SWOT (Strengths, Weaknesses, Opportunities, Threats)** strengths and weaknesses from the internal environment of the project will be identified. Moreover, defining opportunities and threats that may arise from the external environment of the project will offer a clear view of the current situation in the market and will support the partners of DISCO2030 to design an efficient mitigation strategy. A complementary tool that provides additional value, is the PEST analysis. **PEST** detects **political, economic, social, and technological** external factors relative to a specific case study (project, market, or product) that will act as a barrier or requirement for the implementation phase.

  The survey answers can be found in **Error! Reference source not found.**. Annex B.

3.2.1.1. Exploitation Plan for Oerlikon's Project Results

Executive Summary

Oerlikon aims to exploit innovative manufacturing techniques for joining copper alloy PBF-LB/M structures with Nickel alloy P-DED-LB structures and integrating aluminium alloy PBF-LB/M thin wall structures with aluminium alloy DED bulky structures. These developments target the space hardware market and thermal management systems for various industries, offering potential for significant cost savings, reduced material consumption, and shorter lead times.

Key Business Goals

- New Product Markets: Introducing multi-material combustion chambers for rockets and components for hydrogen transportation infrastructure.
- Cost Reduction: Achieving lower production costs through reduced process steps and decreased raw material usage.
- Market Expansion: Extending from component manufacturing to complete assemblies, enhancing market reach and capabilities.

Target Markets

- Geographic Focus: European market, particularly for space hardware applications.
- Industrial Sectors: Space, marine, semiconductor, aerospace, defence, and industrial machine tools.
- Customer Profiles: Private and state space companies (e.g., Avio, Arianne, ESA), industries requiring thermal management solutions, and emerging hydrogen storage applications.

Market Analysis

- Potential Market Size: Currently under evaluation by the Business Development team.
- Existing Competitors/Technology: Significant competition from established manufacturers in the US and China.
- Foreseen Sales Numbers (5-year Horizon): Under development in collaboration with the Business Development team.

Exploitation Strategy and Roadmap

- Short-term: Develop and demonstrate prototype technologies to generate market interest.
- Medium-term: Begin small-scale production and establish customer relationships in targeted high-value industries.
- Long-term: Achieve full-scale production and widespread market penetration following the necessary qualification and certification processes.

Cost Considerations

- Direct Costs: Investment in large-scale PBF-LB/M machinery (approx. €3 million) and P-DED-LB/M systems (over €1 million).
- Indirect Costs: R&D, prototyping, and marketing expenses.

Growth Benefits and Expectations

- Employment: Potential increase in skilled blue-collar and white-collar employees over the next five years, particularly at the Munich R&D centre
- Organizational Benefits: Enhanced innovation capability, sustainability, growth, and improvement in product value chains by internalizing more supply chain processes.

Collaborative Efforts

- Internal Collaboration: Engage with R&D departments, especially in Munich and the USA, for technology development and process optimization.
- External Collaboration: Work with project partners and industry stakeholders to validate and deploy the new technologies.

Funding and Investment Needs

- Primary Funding: Internal funding from Oerlikon Group, supported by customer orders.
- Supplementary Funding: Potential for national, regional, and European funding schemes to support R&D and scale-up efforts.

Challenges and Mitigation Strategies

- Technical Challenges: Ensuring the technology is market-ready and reducing costs through process optimization.
- Market Challenges: Overcoming long qualification periods in industries like aerospace; engaging less regulated markets like semiconductor and hydrogen.
- Internal Challenges: Addressing reduced production capacity in Europe following the closure of the PBF/LB factory in Germany.

Implementation - SWOT Analysis

Strengths:

- Comprehensive value chain coverage.
- Insights from diverse end-user markets.
- Strong R&D connections.

Weaknesses:

- Closure of German factory limits skilled workforce.
- High investment risk without firm customer commitments.
- Limited in-house production of certain metal powders.

Opportunities:

- Growing demand for hydrogen applications in Europe.
- Increased funding for European space capabilities.
- Rising defence expenditures in Europe.

Threats:

- Competition from US and Chinese manufacturers.
- Slow development of the hydrogen economy.
- Potential reduction in European space funding.
- High energy costs affecting raw material prices.

Implementation - PESTEL Analysis

Political Factors:

- Trade relations impacting competitive landscape.
- Defence spending by European governments.
- Commitment to European space launch capabilities.

Economic Factors:

- Investment pace in the hydrogen economy.
- Cost limitations for mass-market applications.
- Sensitivity to global economic trends.

Social Factors:

- Shortage of specialized technicians and engineers.
- Public acceptance of increased space and defence funding.

Technological Factors:

- Adoption of new laser technologies.
- Impact of reusable rocket engines on demand.
- Advances in DED technology.

Environmental Factors:

- Benefits from lower material and energy consumption.
- Impact of mining regulations on raw material costs.

Conclusion

Oerlikon's strategy focuses on leveraging advanced manufacturing technologies to enter new markets and reduce costs. Successful exploitation depends on addressing technical, market, and internal challenges while securing necessary funding and maintaining competitive advantages through innovation and strategic collaborations.

3.2.1.2. Exploitation Plan for AVIO's Project Results

Key Business Goals

The primary business goal for the exploitation of this result is to:

Introduce Multi-material Combustion Chambers: Develop and market advanced combustion chambers for the launcher development industry, enhancing rocket engine performance through improved heat extraction, increased component lifetime, and enhanced structural integrity.

Cost and Time Reduction: Lower production costs by leveraging expertise in design and manufacturing processes and achieve faster production timelines compared to traditional methods. Reusing surplus print powder further enhances cost-effectiveness.

Market Expansion: Broaden AVIO's expertise in rocket engine component design and expand its presence in the space launcher market, ultimately enabling the development of high-thrust engines for carrying heavier payloads to orbit.

Target Markets:

- Geographic Focus: European Contribution: Significant contribution to the European rocket engine development market.
- Industrial Sector: Aerospace Industry: Specifically targeting the small launchers market.

Market Analysis:

- Customer Profile: Private and State Space Companies: National and international space agencies.
- Potential Market Size: Under Estimation: The exact market size is currently being evaluated.
- Existing Competitors / Technology: Competitors: Private and state space companies globally, including those in the US and China.
- Foreseen Sales Numbers (5 years upon market entry): Under Estimation: Sales numbers are currently being evaluated.

Exploitation Strategy and Roadmap

- Short Term Goals: Develop Sub-Scale Demonstrators: Perform full characterization and firing tests to enhance confidence and technological readiness levels (TRL) in bimetallic combustion chambers.
- Medium Term Goals: Develop Full-Scale Engines: Apply knowledge from subscale demonstrators to develop increasingly powerful full-scale rocket engines.
- Long Term Goals: Qualify Engines for Flight: Ensure full-scale rocket engines are qualified for flight and capable of carrying higher payloads into orbit.

Cost Considerations

- Direct Costs: Investment for scaling up rocket engines qualified for flight (> €10 million).
- Indirect Costs: R&D, prototyping, and marketing expenses (> €1 million).

Growth Benefits and Expectations

- Potential Increase in employees: Yes, but the exact number is under evaluation.
- Profile: Engineers in aeronautical, aerospace, mechanical, and material engineering, along with technical experts and managers.

Benefits:

- Innovation Capability: Consolidate and expand expertise in rocket engine design, particularly with bimetallic combustion chambers.
- Sustainability: Optimize process cost-effectiveness through reuse of surplus print powder and enhance part reusability.
- Growth: Develop reusable high-thrust rocket engines, enhancing payload capacity.
- Product Value Chain Improvement: Reduce production costs and increase manufacturing speed.

Collaborative Efforts

- Collaboration with Other Project Partners: Maybe, depending on the alignment of objectives.
- Industrial Sector: Aerospace, particularly the small launchers development market.
- Geographic Focus: Europe.
- Customer Profile: Private and state space companies, national and international space agencies.

Challenges and Mitigation Strategies

- Technical Challenges: Achieving required TRLs and optimizing design for bimetallic chambers.
- Uncertain Exploitation Strategy: Currently under evaluation.
- Internal Challenges: Potential underperformance in test articles.
- Other Challenges: Evaluation ongoing.

Contingency Plans for Exploitation Risks

- R&D Investment: Conduct extensive testing under varied conditions.

Funding Needs

- Sources: Internal, national, regional, and international funding, including European and ESA support.

Post-Project Investment Funding

- Evaluation: Participation in future R&D projects and securing both state and private funding.

Implementation – SWOT Analysis

Internal Strengths

- Expertise in liquid rocket engines.
- Know-how in engine testing.
- Experience in launchers development.
- Supervision of additive manufacturing processes.
- Strong R&D connections.

Internal Weaknesses

- Risk of not meeting technical goals.
- Potential funding shortfalls for analysis and tests.

External Opportunities

External Threats

- Competition from global companies.
- Potential reduction in European space funding.

Implementation – PESTEL Analysis

Political Factors

- Commitment to European space launch capabilities.
- Trade relations impacting competition.
- Re-alignment of market requirements.

Economic Factors

- Investments in aerospace industry.
- Cost limitations for mass applications.
- Sensitivity to global economic trends.

Social Factors

- Availability of specialized engineers.
- Improvements in human life.
- International dynamics and balance.

Technological Factors

- Prototype industrialization.
- Manufacturing efficiency.
- Overall process optimization.

Environmental Factors

- Development of green propellants.
- Reusability of engines.
- Sustainability through powder recovery.

Legal Factors

- Under Evaluation: Specific legal factors are being assessed.

End-User Implementation

- Benefits: Innovation, sustainability, higher payload capacity.
- Risks: Not meeting technical goals or TRL targets.
- Difficulties: Technical feasibility challenges.
- Barriers: Space product exportation laws and constraints.

Conclusion

AVIO's exploitation strategy for the development of multi-material combustion chambers is centred on leveraging advanced additive manufacturing techniques to enhance rocket engine performance, reduce production costs, and expedite manufacturing timelines. By focusing on the European aerospace market and targeting private and state space companies, AVIO aims to expand its presence in the space launcher market. The strategy includes developing sub-scale demonstrators, progressing to full-scale engines, and ultimately qualifying these engines for flight to carry higher payloads into orbit. Despite technical challenges and competitive pressures, AVIO's strengths in liquid rocket engine design, testing, and additive manufacturing, combined with strategic R&D investments and collaborations, position the company to drive innovation and growth. In conclusion, AVIO's well-rounded exploitation strategy not only aims to reinforce its market position but also contributes significantly to advancing European space capabilities.

3.2.1.3. Exploitation Plan for Wärtsilä Project Results

Executive Summary

Wärtsilä is developing innovative charge air coolers for marine applications, leveraging Additive Manufacturing (AM) techniques such as Laser Powder Bed Fusion (LPBF) and Directed Energy Deposition (DED). These heat exchangers aim to improve engine performance by adopting dissimilar materials, including copper and stainless steel, to enhance cooling efficiency and power density. The project aligns with Wärtsilä's goal of creating sustainable solutions while maintaining cost efficiency. This business exploitation plan outlines the strategy to bring this product to market, overcome challenges, and leverage internal and external resources.

Objectives

- New Product Development: To develop advanced charge air cooler systems, boosting Wärtsilä’s engine performance and design flexibility.
- Cost per Kilowatt Reduction: Increase the engine power density while retaining competitive pricing.
- Market Expansion: Penetrate the marine and energy markets with a focus on sustainable and efficient technologies.

Market Analysis

Target Markets:

- Geographical Focus: Global sales targeting marine and energy markets.
- Industrial Sectors: Marine transportation and power plant operators.
- Customer Profiles: Private and state-owned marine and energy production companies.

Market Size: The potential market size is under evaluation by the Product Management team, but Wärtsilä intends to lead in this niche market as competitors have yet to provide ready solutions.

Competitors: Current competitors lack equivalent AM solutions, positioning Wärtsilä to lead the development of advanced heat exchangers.

Sales Projections: Wärtsilä aims to establish its presence in the market over a five-year period, with projections still under development.

Exploitation Strategy

- Short-Term Goals (1-2 years): Technical Demonstration - Develop and showcase the technical feasibility and performance improvements of the DISCO2030 solutions, focusing on heat exchange applications in charge air coolers.
- Medium-Term Goals (3-4 years): Product Development - Design and launch a new charge air cooler integrated with AM-produced heat exchangers.
- Long-Term Goals (5+ years): Standardization - Ensure AM-developed heat exchangers become the standard solution for Wärtsilä engines, benefiting both existing and future engine models.

Implementation Strategy

Technological Development

- Adoption of Dissimilar Materials: Utilize advanced copper heat exchange elements with stainless steel covers, enabled by AM techniques (LPBF and DED).
- R&D Focus: Continue to refine the robustness and efficiency of the prototypes through standardized testing and simulations.

Cost Structure

- Direct Costs: Manufacturing expenses associated with the production of heat exchangers using AM techniques.
- Indirect Costs: Design, validation, laboratory testing, and simulations needed to verify performance.

Penetration Strategy

- Internal Buy-In: Overcome internal skepticism by involving technical and sales teams early in the development process.
- Customer Engagement: Address potential customer skepticism by offering demonstrators, clear benefits in terms of cost per kilowatt, and performance gains.

Resource Allocation

- Internal Funding: Primary investment will be sourced from Wärtsilä's internal funds, with potential supplementary funding from national, regional, or European grants for R&D and scaling up.
- Human Resources: Potentially increase the workforce at Wärtsilä's Vaasa STH (Sustainable Technology Hub) with specialized blue-collar and white-collar employees.

Risk Management

Technical Risks

- Challenge: Ensuring product robustness, particularly concerning fatigue life, leak-proof designs, and maintenance reliability.
- Mitigation: Conduct extensive laboratory tests and simulations, and create contingency plans for further technical development.

Market Risks

- Challenge: Overcoming customer hesitation regarding new technologies.
- Mitigation: Provide transparent demonstrations of performance improvements and cost benefits, ensuring clear communication of AM's advantages.

Internal Challenges

- Challenge: Engaging the sales and marketing departments, overcoming skepticism about the robustness of new technologies.
- Mitigation: Involve cross-departmental collaboration and continuous feedback during the development phases.

SWOT Analysis

Strengths

- Technological Expertise: Strong R&D capabilities in AM and heat exchanger technology.
- Innovation Culture: Wärtsilä's focus on innovation facilitates resource allocation for groundbreaking projects.
- Sustainability: Aligns with global decarbonization goals, positioning Wärtsilä as a sustainability leader.

Weaknesses

- Internal Resource Allocation: Testing resources may be diverted to higher-priority projects.
- Scepticism in R&D: Resistance within R&D and Product Management to adopting novel technologies.

Opportunities

- Market Leadership: Potential to set industry standards in advanced heat exchangers for marine and energy applications.
- Technological Advancement: Continuous innovation in AM processes and materials may provide Wärtsilä with a significant competitive edge.

Threats

- Supply Chain Issues: AM market contraction could lead to higher costs, limiting scalability.
- Customer Acceptance: Slow customer adoption due to hesitancy around new technologies.

PESTEL Analysis

Political Factors

- Global Conflicts: International conflicts may disrupt Wärtsilä's global supply chain.
- Marine Trade Restrictions: New regulations affecting marine transport could impact Wärtsilä's primary markets.

Economic Factors

- Economic Restrictions: Conflicts and trade sanctions could lead to economic instability affecting the marine and power industries.

Social Factors

- Skills Shortage: A lack of specialized technicians and engineers may limit Wärtsilä's ability to scale up production.

Technological Factors

- Advances in AM: Rapid technological progress in AM materials and processes could either accelerate or challenge Wärtsilä's product development.

Environmental Factors

- Emission Regulations: Increasing pressure to lower engine emissions could create both challenges and opportunities.

Legal Factors

- Intellectual Property: Wärtsilä needs to secure patents for new innovations in AM heat exchangers to protect its market position.

Conclusion

Wärtsilä's development of advanced heat exchangers for charge air coolers promises to enhance engine performance and sustainability. By capitalizing on AM technology and dissimilar material use, the company aims to set new standards in the marine and energy sectors. This business exploitation plan addresses the necessary steps, risk management strategies, and market engagement approaches required to ensure successful commercialization. Through internal funding, leveraging its innovative culture, and carefully navigating market and technological risks, Wärtsilä can secure its leadership in this emerging field.

3.2.1.4. Exploitation Plan for Cryomotive Project Results

Executive Summary

Cryomotive aims to exploit optimized and more integral design solutions for the hydrogen storage vessel by joining different manufacturing techniques (PBF and DED) in combination with innovative thermoplastics overwrapping. These results into a more cost- and weight-optimized solution allowing Cryomotive to offer solutions for various markets and a wider range of potential customers.

Key Business Goals

- New Product Markets: Introducing the weight optimized solution into weight sensitive applications, like air mobility and aerospace in general.
- Cost Reduction: Achieving lower production costs through reduced process steps and decreased raw material usage.
- Insourcing: Establishing the manufacturing and production as an inhouse capability with an acceptable level of investment.

Target Markets

- Geographic Focus: European market, followed by the US market.
- Industrial Sectors: Aerospace, transportation (light and heavy duty)

Market Analysis

- Potential Market Size: Currently under evaluation by the Business Development team.
- Existing Competitors/Technology: Initial competition from newly established manufacturers in the US and China.
- Foreseen Sales Numbers (5-year Horizon): Under development in collaboration with the Business Development team.

Exploitation Strategy and Roadmap

- Short-term: Develop and demonstrate prototype technologies to generate market interest.
- Medium-term: Begin small-scale production and establish customer relationships in targeted industries and markets.
- Long-term: Achieve full-scale production and widespread market penetration following the necessary qualification and certification processes.

Cost Considerations

- Direct Costs: Investment in large-scale PBF-LB/M machinery, P-DED-LB/M systems and upgrades on the winding machines ready to be used for thermoplastics (approx.. 6 million in total).
- Indirect Costs: R&D, prototyping, and marketing expenses.

Growth Benefits and Expectations

- Employment: Potential increase in skilled employees over the next five years (up to 10 FTE)
- Organizational Benefits: Enhanced innovation capability, sustainability, growth, and improvement in product value chains by internalizing more supply chain processes (“in-sourcing”).

Collaborative Efforts

- External Collaboration: Work with project partners and industry stakeholders to validate and deploy the new technologies.

Funding and Investment Needs

- Supplementary Funding: Potential for national, regional, and European funding schemes to support R&D and scale-up efforts.

Challenges and Mitigation Strategies

- Technical Challenges: Ensuring the technology is market-ready and reducing costs through process optimization.
- Market Challenges: Overcoming long qualification periods in industries like aerospace.
- Internal Challenges: Ensuring a technology transfer and readiness during the foreseen expansion strategy.

Implementation - SWOT Analysis

Strengths:

- Leadership on the cryo-compressed technology.
- Insights from diverse end-user markets.

Weaknesses:

- Start-up company with limited resources.
- High investment risk without firm customer commitments.

Opportunities:

- Growing demand for hydrogen applications in Europe.
- Increased funding for zero-emission application, like aerospace, transportation.

Threats:

- Competition from US and Chinese manufacturers.
- Slow development of the hydrogen economy in Europe / Germany.
- High energy costs affecting raw material prices.

Implementation - PESTEL Analysis

Political Factors:

- Trade relations impacting competitive landscape.
- Public funding on zero-emission eco-system.
- Commitment to European environmental targets.

Economic Factors:

- Investment pace in the hydrogen economy.
- Acceptance of cryo-compressed technology.
- Cost limitations for mass-market applications.
- Sensitivity to global economic trends.

Social Factors:

- Shortage of specialized technicians and engineers.
- Public acceptance of the transition to a zero-emission ecosystem.

Technological Factors:

- Acceptance of cryo-compressed technology.
- Implementation of the necessary regulatory framework.

Environmental Factors:

- Benefits from availability of hydrogen for transportation demands.
- Improvement in circular economy to reduce the CO2-footprint over lifetime.

Conclusion

Cryomotive´s strategy focuses on further developing design and manufacturing improvements to optimize manufacturing effort and overall system cost. This will lower the burden for expansion into new markets and industries. Successful exploitation depends on the next steps in the transition to a zero-emission ecosystem supported by necessary funding and regulatory boundaries. Strategic collaborations are key to support the foreseen market penetration and expansion into new sectors.

3.2.1.5. Exploitation Plan for DLR's Project Results

Key Business Goals

DLR's goal is to present itself as a provider of high-quality testing services for liquid rocket engines and a key partner for their development, with the objective to strengthen reputation as a preferred test service and technical expertise provider for European liquid rocket engine developers.

Target Markets

- Current Market: Services for established and new space startups during liquid rocket engine development and qualification phases.
- Geographical focus: Market is mainly European; non-European customers possible but limited by export control regulations.
- Industry sector: Focus areas include space transportation and established/new-space engine manufacturers.

Growth Benefits and Expectations

Employment: Increase in the number of Employees in 5 years: 1-2 white collar, test engineers.

Collaborative Benefits from Project Results

- Improved competence in 3-D printing for rocket combustion chambers.
- Increased interest in DLR's test infrastructure.
- Potential collaboration with other project partners in the future.

Implementation - SWOT Analysis

Internal Strengths:

- High interest in demonstrated technology (copper/nickel bi-metal printing).
- Reputation of tests being highly representative of real industrial use-cases.
- Collaboration with well-known partners (AVIO, Oerlikon).
- Exciting video footage from rocket engine hot fire testing.

Internal Weaknesses:

- Confidentiality of most measured data due to commercial interests of partners.

External Opportunities:

- Increased social media reach through dissemination via LinkedIn channels of all use-case partners.

Implementation - PESTLE Analysis

Political Factors:

- Re-nationalization of space transportation in Europe may limit the desired effect of drawing more customers to DLR Lampoldshausen test infrastructure.

Environmental Factors:

- Potential public concern over CO2 emissions from testing with liquid natural gas.

Conclusion

DLR's exploitation strategy focuses on reinforcing its position as the premier provider of high-quality testing services for liquid rocket engines in Europe. By leveraging its established expertise and reputation, DLR aims to cater to both established space transportation companies and new-space startups during the development and qualification phases of liquid rocket engines. The strategy includes disseminating test results through scientific conferences and social media channels like LinkedIn, despite challenges related to the confidentiality of data due to commercial interests. This approach is expected to boost DLR's innovation capabilities, enhance its competence in 3-D printing for rocket combustion chambers, and potentially attract new customers and employees.

3.2.1.6. Exploitation Plan for EWF's Project Results

The European Welding Federation (EWF) aims to leverage the outcomes of the DISCO2030 project primarily for dissemination purposes. By utilizing the project's extensive network, collaborative efforts, and expert insights, EWF plans to validate its training programs and certifications, ensuring they meet the highest standards. These validated results will be shared during EWF's General Assembly and at the International Institute of Welding (IIW) events, enhancing the visibility and credibility of EWF's initiatives. Additionally, the technical knowledge gained from DISCO2030 will enable EWF to forecast future skill requirements and update its system, accordingly, fostering new collaborations and further disseminating these advancements throughout the industry.

3.2.1.7. Exploitation Plan for TUM's Project Results

TUM is dedicated to fulfilling the objectives outlined in the consortium agreement and the initial DEC report by the project's conclusion. One of the primary goals, as detailed in D2.1, is to ensure that research outputs are accessible via the TUM open access depository. This objective will be achieved by adding publications to the MediaTUM depository, an open access repository managed by the TUM Library. MediaTUM adheres to FAIR (Findable, Accessible, Interoperable, and Reusable) standards, ensuring the stored data meets high-quality benchmarks. The first

publication has already been successfully uploaded to this depository, marking a significant milestone in the project's commitment to open access and transparency.

To disseminate the academic knowledge generated through the DISCO2030 research, TUM MAT (Chair of Materials Engineering of Additive Manufacturing) plans to produce several academic publications focusing on the manufacturing of graded structures using Directed Energy Deposition (DED) methods and process simulation. These publications will be submitted to prominent international journals as outlined in D2.2, ensuring that the findings reach a wide academic audience. In addition to journal publications, TUM MAT will actively participate in conferences, such as those specified in D2.3, to present their research findings to the academic community and industry stakeholders. The first of these presentations took place in June 2024 at the Virtual Manufacturing 2024 event, where the team presented insights gained from the process simulation of multi-material plasma DED. This event was a significant opportunity to share their progress and gather feedback from peers.

Furthermore, TUM MAT is planning to organize an on-site workshop focused on multi-material DED printing. This workshop will serve as a platform to demonstrate the proficiency gained in in-situ alloying of dissimilar metals, showcasing the advanced techniques and results achieved through their research. The event aims to foster further collaborations with other EU project partners, enhancing the collective knowledge and capabilities in this cutting-edge field. This initiative aligns with the requirements specified in D2.4 and underscores TUM MAT's dedication to practical application and collaborative innovation. By bringing together researchers, industry experts, and stakeholders, the workshop will not only highlight TUM MAT's advancements but also stimulate new ideas and partnerships that can drive future developments in multi-material DED printing and related technologies.

TUM LCC (Chair of Carbon Composites) will disseminate the DISCO2030 results to the academic community, e.g. conference or journal publications. The already established industrial channels to polymer producers will get feedback of their products for cryogenic applications of metal-polymer composite hybrids. Communication of the results to industrial partners in the form of workshops or presentations to transfer DISCO2030's results into extended industrial considerations.

3.2.2. Actions to Reach Higher TRLs

It is important to understand the project's positioning and innovation potential as well as the role and contribution of each partner in its development. **Oerlikon** and the use-case partners **Avio**, **Wärtsilä** and **Cryomotive** have reached an agreement in principle to continue the cooperation post-project to **bring the technology towards TRL 9**. Key activities to be focused on post-EU-project include increasing technology robustness and ensuring commercial acceptance among new customers. An important aspect will also be the set-up of a well-functioning manufacturing value chain within Oerlikon and its facilities to be able to deliver the expected components to clients in a timely manner.

3.2.3. Financing post-EU-project

It is expected that additional 8-10 million EUR in financing will be required to bring the DISCO2030 technologies to TRL 9 post-project. These will be covered mainly by Oerlikon and the use-case partners. The partners perceive EU-funding as a crucial stepping stone towards de-risking the low TRL technologies and provide enough confidence into the commercial potential offered by it to the consortium, but also Europe as a whole. By setting up a new manufacturing

facility in either Italy or Germany, Oerlikon will offer the EU taxpayers a significant return-on-investment by further developing technologies within the EU and creating new high-skilled jobs in the EU. Last but not least, the technology will also contribute to increasing the EU industry's resilience against disruptions in non-EU supply chains.

3.3. Strategy for Intellectual Property (IP) Management

A patent search conducted during the state-of-the-art mapping using the **Espacenet tool** has confirmed that freedom to operate exists for the technologies being proposed. The table below summarises the types of foreground IP to be generated in the project. The background IP partners bring to the project include sensor integration IP by LKR, original use-case component designs by the use-case partners, process parameters for the respective AM technology building blocks (OER AM/OER MET, LKR, TUM MAT, TUM LCC).

Table 8 - DISCO2030 foreground IP.

Item	Owner	Protection
Design guidelines.	LKR/OER AM/OER MET	Trade secret
Novel testing procedures for dissimilar materials.	TUM MAT/TUM LCC/LKR/OER AM/MET	Patent
Metal-metal hybrid manufacturing method process parameters.	TUM MAT/OER AM/OER MET	Patent
Metal-polymer hybrid manufacturing method process parameters.	TUM LCC/LKR	Patent
Fiberglass sensor integration via W-DED.	LKR	Patent
Designs of the demonstration components.	Avio (rocket engine)/WAR (marine engine)/CMO (hydrogen tank)	Copyright/trade secret
Training materials and standardization recommendations.	EWF	Copyrights

The overall exploitation plan has been completed, based on the IP defined in the proposal and further refined during consortium agreement negotiations. The Consortium agreement is now signed and finalized. The draft plan (including the DISCO2030 business case) evolved throughout the project implementation and can be found in this DEC Plan.

4. Annexes

4.1. Annex A

DISCO2030 Partner Exploitation Survey

Deliverable D5.1 (M19)

* Required

General info and background

1. Partner Organization *

2. Name *

3. Contact *

4. Project Result Designation *
Please describe the project results your organization is aiming to exploit

5. Explain what is the key business goal for the exploitation of this result. *
(e.g.: sales increase for an existing product, new markets and clients, cost reduction, etc.)

6. Considering the current markets where your organisation operates, refer in which DISCO2030 results will be exploited: *

7. For the markets identified above, please detail the topics below. *

1. Geography, 2. Industrial Sector, 3. Customer Profile

8. For the markets identified above, please detail the topics below. *

4. Potential Market Size, 5. Existing Competitors/Technology, 6. Foreseen sales numbers after 5 years upon market entry

9. For the markets identified above, please detail the topics below. *

7. Exploitation strategy/roadmap, 8. Penetration strategy (short, medium and long term)

10. Detail the costs associated to the exploitation of results *

(Direct Costs and Indirect Costs)

Growth, benefits and expectations

11. Can this project result lead to an increase in your organization's employees' number? *

- ◯ Yes
- ◯ No

12. Number of potential new employees, after a 5-year period *

If previous answer was no, write n/a

13. Profile of the new employees *

White and/or blue collar, job function

14. Will your organisation benefit from the project results in terms of: *

Select the suitable options

- ☐ **Innovation capability** (New product, novel design for an existing technology, etc.)
- ☐ **Sustainability** (e.g., energy savings, material utilization, process optimization)
- ☐ **Growth** (New business area, new markets, increase in sales numbers, etc)
- ☐ **Product value chain improvement** (Reduced costs for your organization, benefits for your customers)
- ☐ Other

15. Considering the selection above, please describe in detail how your company will benefit from the project's results. *

16. Will you engage with other project partners to exploit the results? *

- ◯ Yes
- ◯ No
- ◯ Maybe

17. How have you identified your market, its size and characteristics? *

Challenges

18. Please describe the expected difficulties in exploiting the project's results regarding necessary steps to begin exploitation. *

Product may not be market ready, further technical development is needed, etc.

19. Please describe the expected difficulties in exploiting the project's results considering that the exploitation strategy may not yet be defined. *

Where, how, to whom will the result be exploited?

20. Please describe the expected difficulties in exploiting the project's results regarding internal challenges *

Low engagement with sales/marketing department, etc.

21. Please describe the expected difficulties in exploiting the project's results regarding any other identified challenges *

22. Please describe any contingency plans to be put in place to mitigate exploitation risks: *

23. To assure the exploitation of results, what are the funding needs for your organization? *

24. How will you fund the investment needed to exploit the project results after the project has ended. *

Internal funding? National or Regional funding? Other European funding scheme?

Implementation - SWOT Analysis

25. Considering the goal of exploiting the project results, please identify **5 Strengths (internal)** *

26. Considering the goal of exploiting the project results, please identify **5 Weaknesses (internal)** *

27. Considering the goal of exploiting the project results, please identify **5 Opportunities (external)** *

28. Considering the goal of exploiting the project results, please identify **5 Threats (external)** *

Implementation - PESTEL Analysis

29. Please identify **3 Political** factors that may influence the exploitation of the project's results. *

30. Please identify **3 Economic** factors that may influence the exploitation of the project's results. *

31. Please identify **3 Social** factors that may influence the exploitation of the project's results. *

32. Please identify **3 Technological** factors that may influence the exploitation of the project's results. *

33. Please identify **3 Environmental** factors that may influence the exploitation of the project's results. *

34. Please identify **3 Legal** factors that may influence the exploitation of the project's results. *

Implementation end-users / customers

35. Regarding the implementation of the project's results in the end-users, please decribe: 1. Benefits, 2. Risks, 3. Difficulties, 4. Barriers *

4.2. Annex B

Detailed Business Model Canvas

Key Partners

1. Project Partners and Industry Stakeholders:

- European space companies (e.g., Avio, Arianne, ESA)
- Industrial partners in the marine, semiconductor, aerospace, defence, and machine tool sectors
- Universities and research institutions involved in R&D

2. Internal Entities:

- R&D centres
- Production facilities
- Business development departments

3. Funding and Support Organizations:

- Potential regional and national funding bodies in Bavaria and Germany
- European funding schemes

Key Suppliers

1. Raw Material Suppliers:

- Suppliers of metal powders, including iron, titanium, and nickel base alloys
- Potential suppliers for aluminium and copper powders, which Oerlikon does not currently produce in-house

2. Machinery and Equipment Suppliers:

- Manufacturers of largescale PBFLB/M machines
- Suppliers of PDEDLB/M systems

Key Resources Acquired from Partners

1. Technical Expertise and Innovation:

- Advanced R&D capabilities from universities and research institutions
- Specialized knowledge in multi-material additive manufacturing

2. Funding and Financial Support:

- Grants and financial support from regional, national, and European funding bodies
- Investments from internal Oerlikon group resources

3. Market Insights and Customer Requirements:

- Input from diverse market participants and potential end-users
- Insights into industry-specific needs and regulatory requirements

Key Activities Performed by Partners

1. Research and Development:

- Joint R&D projects with universities and research institutions to refine and optimize additive manufacturing processes
- Collaborative development of demonstrator prototypes to showcase technology

2. Market Development and Customer Engagement:

- Partnerships with industry stakeholders to validate technologies and gain market acceptance
- Engagement with end-users to tailor solutions to specific market needs

3. Regulatory and Certification Support:

- Assistance with meeting qualification and certification requirements in aerospace and other high value industries
- Support in navigating regulatory landscapes for new technologies and applications

Key Activities

Key Activities Required for Value Propositions

1. Research and Development (R&D):

- Ongoing development and refinement of multi-material additive manufacturing techniques.
- Prototype development and testing to demonstrate the feasibility and advantages of new manufacturing methods.

2. Production Optimization:

- Process optimization to reduce manufacturing steps and material consumption.
- Integration of advanced manufacturing technologies into production lines.

3. Certification and Compliance:

- Ensuring new products meet industry standards and regulations, especially in aerospace and hydrogen storage applications.
- Long qualification periods for aerospace applications and other high-value industries.

4. Market Development:

- Identifying and engaging with target markets such as space hardware, thermal management systems, and hydrogen infrastructure.
- Showcasing demonstrator prototypes to generate market interest and validate new technologies.

5. Cost Management:

- Managing high upfront capital costs for new machinery and production facilities.
- Reducing direct and indirect costs through process efficiency and scale-up.

Distribution Channels

1. Direct Sales:

- Direct engagement with key customers in the space, aerospace, marine, semiconductor, and hydrogen industries.
- Utilizing Oerlikon's established sales network and relationships.

2. Partnerships and Alliances:

- Leveraging partnerships with industry stakeholders to comarket and co-develop solutions.
- Collaborations with universities and research institutions for joint ventures and technology demonstrations.

3. Online and Digital Platforms:

- Utilizing digital platforms to market new technologies and reach a broader audience.
- Providing detailed product information and case studies online to attract potential customers.

Customer Relationships

1. Key Account Management:

- Developing and maintaining strong relationships with major clients in targeted industries.
- Providing dedicated support and customized solutions to meet specific customer needs.

2. Customer Support and Services:

- Offering comprehensive after-sales support, including maintenance, training, and troubleshooting.
- Establishing a robust feedback mechanism to continuously improve products and services based on customer input.

3. Engagement through Demonstrations:

- Using demonstrator prototypes to engage with potential customers and showcase the benefits of new manufacturing technologies.
- Participating in industry conferences, trade shows, and exhibitions to build relationships and attract new clients.

Revenue Streams

1. Product Sales:

- Revenue from the sale of advanced multi-material components and assemblies, such as rocket engine parts and integrated heat exchangers.
- Selling high-value products to industries that can tolerate higher costs due to the advantages provided (e.g., space, semiconductor).

2. Service Contracts:

- Offering maintenance and support services for the products sold, providing a steady revenue stream post sale.
- Providing consultation and custom engineering services to optimize the use of Oerlikon's technologies.

3. Licensing and Technology Transfer:

- Licensing the developed manufacturing technologies to other companies or industries.
- Generating revenue through technology transfer agreements and collaborations.

4. Funding and Grants:

- Leveraging regional, national, and European funding schemes to support ongoing R&D and commercialization efforts.
- Utilizing grants and subsidies, particularly in the context of the hydrogen economy and space industry developments.

Value propositions

Value Delivered to the Customer

1. Innovation in Manufacturing:

- Advanced multi-material additive manufacturing techniques that enable the production of complex, multifunctional parts.
- High quality components with reduced production steps and material usage, resulting in faster lead times and cost savings.

2. Cost Efficiency:

- Reduced material consumption and process steps, leading to lower overall production costs.
- Potential for significant cost savings in industries where material and production efficiency are critical.

3. Customization and Flexibility:

- Ability to produce bespoke, high-performance parts tailored to specific customer requirements.
- Flexibility in manufacturing to cater to a wide range of industrial applications.

4. Environmental Sustainability:

- More sustainable production processes with lower energy consumption and material wastage.
- Contribution to greener production methods, aligning with increasing environmental regulations and customer preferences.

Customer Problems Solved

1. Complex Manufacturing Challenges:

- Difficulty in joining different materials to create integrated, high-performance components.
- Need for reducing the number of manufacturing steps and associated costs without compromising quality.

2. High Production Costs:

- High costs associated with traditional manufacturing methods and raw materials.
- Need for cost effective manufacturing solutions that do not sacrifice product integrity.

3. Extended Lead Times:

- Long lead times associated with conventional manufacturing processes.
- Requirement for faster production cycles to meet tight project deadlines.

4. Sustainability Goals:

- Increasing pressure to adopt more sustainable manufacturing practices.
- Need for solutions that reduce environmental impact while maintaining competitive edge.

Bundles of Products and Services Offered to Each Customer Segment

1. Space Industry:

- Multi-material combustion chambers and other high performance rocket engine components.
- Support services including maintenance, customization, and optimization of manufacturing processes.

2. Thermal Management Systems (Various Industries):

- Integrated heat exchanger assemblies for aerospace, marine, semiconductor, and industrial applications.
- Consultation and design services to tailor thermal management solutions to specific customer needs.

3. Hydrogen Storage Applications:

- Components and assemblies designed for hydrogen transportation and storage infrastructure.
- Engineering support to ensure compatibility and performance in hydrogen storage solutions.

Customer Needs Satisfied

1. Performance and Reliability:

- High performance, reliable components that meet stringent industry standards and specifications.
- Assurance of quality and durability in critical applications.

2. Cost Reduction and Efficiency:

- Efficient manufacturing processes that reduce costs and material waste.
- Competitive pricing for high value industries that require advanced manufacturing solutions.

3. Innovation and Advancement:

- Access to cutting-edge manufacturing technologies and materials.
- Continuous innovation to stay ahead of market trends and technological advancements.

4. Environmental and Sustainability Goals:

- Solutions that align with environmental regulations and sustainability goals.
- Reduced carbon footprint and material usage, contributing to corporate sustainability initiatives.

Customer relationships

Customer Relationships by Segment

1. Space Industry

Expected Relationship:

- Key Account Management: Personalized and dedicated support to ensure that the specific needs of high-stake space projects are met.
- Technical Collaboration: Close technical collaboration to codevelop solutions and ensure compliance with stringent industry standards.
- Long-term Partnership: Building long-term partnerships for ongoing projects and future developments.

Established Relationship:

- Dedicated Account Managers: Providing direct points of contact for major clients.
- Technical Support Teams: Offering specialized technical assistance and co-development opportunities.
- Project-based Collaboration: Engaging in joint development projects and regular communication to align on technical requirements.

Integration with Business Model:

- Close Alignment with R&D: Strong integration with R&D to tailor solutions to customer needs and rapidly respond to technological challenges.

- Customer Feedback Loop: Incorporating customer feedback into continuous product and process improvements.

Cost:

- High: Maintaining dedicated account managers and specialized technical teams requires significant investment but is justified by the high value of contracts in the space industry.

2. Thermal Management Systems (Various Industries)

Expected Relationship:

- Customized Solutions: Providing tailored solutions to meet the unique requirements of each industry.
- Technical Support and Training: Offering extensive support and training to ensure the effective implementation and maintenance of systems.
- Responsive Service: Being responsive to maintenance and troubleshooting needs.

Established Relationship:

- Customer Support Teams: Dedicated support teams available for technical assistance and training.
- Service Contracts: Offering service contracts to ensure ongoing support and maintenance.
- Integration with Business Model:
- Service-oriented Approach: Integrating services as a key part of the value proposition to ensure customer satisfaction and loyalty.
- Cross-selling Opportunities: Leveraging service relationships to identify and address additional customer needs, potentially leading to further sales.

Cost:

- Moderate to High: Ongoing support and training require a moderate to high investment, balanced by long-term customer loyalty and additional sales opportunities.

3. Hydrogen Storage Applications

Expected Relationship:

- Innovative Partnership: Collaborating on innovative solutions for emerging markets.
- Regulatory Support: Assisting with compliance and regulatory approvals.
- Educational Outreach: Providing education and information on the benefits and applications of hydrogen technology.

Established Relationship:

- Collaborative Development Projects: Partnering on R&D projects to innovate in hydrogen storage.
- Regulatory Assistance: Offering support to navigate regulatory landscapes.

Integration with Business Model:

- Innovation-driven: Integrating closely with R&D to stay at the forefront of technological advancements and regulatory changes.
- Market Education: Actively educating the market to drive adoption and increase demand for new solutions.

Cost:

- Moderate: The cost of collaborative projects and regulatory support is moderate but essential for market entry and growth in an emerging sector.

Integration with Business Model

- R&D Alignment: Customer relationships are closely tied to R&D efforts, ensuring that the company's technological capabilities are aligned with customer needs.
- Service Integration: Services such as technical support, training, and maintenance are integrated into the business model to enhance customer satisfaction and foster long-term relationships.
- Feedback Mechanism: Customer feedback is systematically collected and used to drive continuous improvement and innovation.
- Cross-selling and Upselling: Customer relationships provide opportunities for cross-selling and upselling additional products and services, thereby increasing revenue.

Cost Implications

- High Initial Costs: Establishing and maintaining these relationships involves significant initial investment in dedicated personnel, technical support teams, and collaborative development projects.
- Long-term Value: The high initial costs are offset by the long-term value generated through strong customer loyalty, repeat business, and opportunities for cross-selling and upselling.
- Scalable Services: Service contracts and ongoing support can be scaled to match the growth of the customer base, providing a balance between cost and revenue.

Customer Segments

1. Space Industry:

- Companies involved in space exploration and satellite technology, such as private space firms and governmental space agencies.
- Organizations requiring high-performance, multi-material components for rocket engines and other space hardware.

2. Aerospace and Defence:

Manufacturers of aircraft, military vehicles, and defence systems that benefit from lightweight, durable, and complex multi-material parts.

Customers looking to integrate advanced thermal management systems to improve efficiency and performance.

3. Thermal Management Systems:

- Industries such as marine, semiconductor, industrial machinery, and automotive that require effective heat exchangers and thermal management solutions.
- Companies seeking to optimize thermal performance in their products and systems.

4. Hydrogen Storage and Transportation:

- Emerging markets in hydrogen transportation and storage infrastructure.
- Firms investing in sustainable and renewable energy solutions, particularly those focusing on hydrogen as an alternative fuel.

5. Industrial Manufacturing:

- Manufacturers seeking to reduce production costs and lead times while maintaining high-quality standards.
- Customers interested in innovative manufacturing techniques that offer customization and flexibility.

Most Important Customers

1. Private and Governmental Space Organizations:

- Examples: Avio, Arianne, European Space Agency (ESA), and other national space agencies.
- Importance: These customers represent high-value contracts and long-term partnerships, driving significant innovation and technological advancements.

2. Aerospace and Defence Contractors:

- Examples: Major aerospace manufacturers and defence contractors that require advanced materials and components.
- Importance: These industries have stringent performance and reliability requirements, making them key beneficiaries of Oerlikon's advanced manufacturing capabilities.

3. Industries Requiring Advanced Thermal Management:

- Examples: Semiconductor manufacturers, marine engineering firms, and industrial machine producers.
- Importance: Effective thermal management is critical in these industries, creating opportunities for Oerlikon to provide tailored solutions that enhance performance and efficiency.

4. Emerging Hydrogen Economy Players:

- Examples: Companies involved in developing hydrogen storage and transportation infrastructure.
- Importance: As the hydrogen economy grows, these customers represent a significant growth area for Oerlikon, aligning with sustainability and renewable energy trends.

5. High-tech Manufacturing Firms:

- Examples: Companies in sectors such as automotive, electronics, and industrial machinery.
- Importance: These firms require innovative manufacturing solutions to stay competitive, making them key targets for Oerlikon's advanced production techniques.

Key Resources

1. Advanced Manufacturing Technologies:

- PBF-LB/M and PDED-LB Systems: Essential for producing high-quality, multi-material components.
- R&D Facilities: Cutting-edge research and development facilities, particularly in Munich and the USA, to innovate and refine manufacturing techniques.

2. Skilled Workforce:

- Engineers and Technicians: Highly skilled engineers and technicians to operate advanced manufacturing equipment and develop new processes.
- R&D Specialists: Researchers and developers focused on material science, process optimization, and product innovation.

3. Raw Materials:

- Metal Powders: high-quality metal powders, including iron, titanium, nickel, aluminum, and copper alloys.
- Supply Chain Relationships: Strong relationships with raw material suppliers to ensure consistent quality and supply.

4. Financial Resources:

- Investment Capital: Sufficient funding for initial capital expenditures, including the purchase of advanced machinery and facilities.
- Operational Budget: Ongoing financial resources to support R&D, production, marketing, and customer support activities.

5. Intellectual Property:

- Patents and Trademarks: Intellectual property protection for proprietary technologies and processes.
- Innovation Pipeline: A continuous stream of new ideas and technologies to stay ahead of competitors.

Key Resources for Distribution Channels

1. Logistics and Supply Chain Management:

- Distribution Network: Efficient logistics and distribution networks to deliver products to customers globally.
- Warehousing: Adequate warehousing facilities to store raw materials and finished products.

2. Sales and Marketing Teams:

- Sales Representatives: Experienced sales teams to engage with potential customers and close deals.
- Marketing Resources: Marketing strategies and tools to promote Oerlikon's technologies and products effectively.

3. Digital Platforms:

- E-Commerce and Online Presence: Digital platforms to showcase products, provide information, and facilitate sales.
- Customer Relationship Management (CRM) Systems: CRM systems to manage customer data and interactions efficiently.

Key Resources for Customer Relationships

1. Customer Support Infrastructure:

- Support Teams: Dedicated technical support teams to assist customers with product usage, maintenance, and troubleshooting.
- Service Centres: Regional service centres to provide timely and localized support.

2. Communication Channels:

- Direct Contact Points: Account managers and customer service representatives to maintain direct and personal contact with key customers.
- Feedback Mechanisms: Systems to collect and analyse customer feedback for continuous improvement.

3. Collaborative Platforms:

- Joint Development Projects: Platforms for collaborating with customers on R&D and product development.
- Technical Workshops and Training: Facilities and resources to conduct training sessions and technical workshops for customers.

Key Resources for Revenue Streams

1. Sales Infrastructure:

- Sales Teams: Trained and motivated sales teams to drive product sales and build customer relationships.
- Distribution Network: Robust distribution channels to ensure products reach customers efficiently.

2. Financial Management Systems:

- Billing and Invoicing: Efficient billing and invoicing systems to manage transactions.
- Financial Analytics: Tools and resources to analyse financial performance and optimize revenue streams.

3. Product and Service Offerings:

- Product Portfolio: A diverse range of products tailored to different customer needs and industries.

- Service Contracts: Service and maintenance contracts to generate recurring revenue.

Channels

1. Preferred Channels by Customer Segments:

- Space Industry: Direct engagement through key account management, industry events, and technical collaborations.
- Aerospace and Defence: Personalized sales visits, industry conferences, technical workshops, and direct collaborations.
- Thermal Management Systems (Various Industries): Digital platforms for product information, direct sales, technical support teams, and industry-specific trade shows.
- Hydrogen Storage and Transportation: Collaborative projects, regulatory support channels, and educational outreach through industry forums.
- High-tech Manufacturing Firms: Online presence for information, direct sales channels, and service contracts for ongoing support.

2. Current Channels Used:

- Direct Sales: Key account managers and dedicated sales representatives engage with major clients.
- Industry Events: Participation in trade shows, conferences, and exhibitions to showcase technologies and network with potential customers.
- Digital Platforms: Company website, online product catalogues, and digital marketing campaigns.
- Collaborative Projects: Joint development initiatives with strategic partners and customers.
- Customer Support Teams: Dedicated teams providing technical support and customer service.

3. Integration of Channels:

- CRM Systems: Integration of customer relationship management systems to streamline interactions and maintain a unified customer database.
- Unified Communication: Consistent messaging and branding across all channels to ensure a cohesive customer experience.
- Feedback Loop: Regular collection and integration of customer feedback from various channels to improve products and services.

4. Best Performing Channels:

- Direct Sales and Key Account Management: High success in building strong relationships and securing large contracts, particularly in the space and aerospace sectors.
- Industry Events: Effective for networking, brand exposure, and direct engagement with potential customers.
- Collaborative Projects: Successful in fostering innovation and long-term partnerships with strategic customers.

5. Most Cost-Efficient Channels:

- Digital Platforms: Online presence and digital marketing provide a wide reach at a relatively low cost compared to traditional marketing methods.
- Customer Support Teams: Cost efficient in maintaining customer satisfaction and loyalty, leading to repeat business and long-term relationships.
- Service Contracts: Provide recurring revenue streams while ensuring continuous customer engagement.

6. Integration with Customer Routines:

- Seamless Communication: Regular updates and direct communication through preferred channels (e-mail, phone, online platforms) to stay aligned with customer routines.
- Scheduled Maintenance and Support: Proactive scheduling of maintenance and support services to minimize disruption to customer operations.
- Online Portals: Providing customers with access to online portals for easy management of orders, service requests, and support tickets.
- Feedback Mechanisms: Routine collection of feedback during and after service interactions to continuously adapt and improve offerings.

Cost Structure

1. Research and Development (R&D):

- Continuous investment in R&D to innovate and refine multi-material additive manufacturing technologies.
- High costs associated with maintaining advanced R&D facilities, particularly in Europe and the USA.
- Salaries and benefits for skilled researchers, engineers, and technicians.

2. Advanced Manufacturing Equipment:

- Capital expenditure on high-end manufacturing systems such as PBFLB/M and PDEDLB.
- Ongoing maintenance and upgrades of manufacturing equipment to ensure high performance and reliability.

3. Raw Materials:

- Procurement of high-quality metal powders (e.g., iron, titanium, nickel, aluminum, copper alloys).
- Managing the supply chain to ensure a consistent supply of these critical materials.

4. Specialized Workforce:

- Costs related to hiring, training, and retaining a skilled workforce, including engineers, technicians, and support staff.
- Competitive salaries and benefits to attract top talent in the field.

5. Customer Support and Service Infrastructure:

- Establishing and maintaining customer support teams and service centres to provide technical assistance and training.
- Expenses related to aftersales services, maintenance contracts, and customer engagement activities.

6. Sales and Marketing:

- Investment in sales teams, marketing campaigns, and participation in industry events and trade shows.
- Digital marketing efforts to promote products and services online.

Most Expensive Key Resources

1. Advanced Manufacturing Technologies:

- High cost of acquiring and maintaining state-of-the-art manufacturing systems (PBF-LB/M, PDED-LB).
- Investment in cutting-edge R&D facilities and equipment for continuous innovation.

2. Skilled Workforce:

- Salaries and benefits for highly skilled engineers, technicians, and researchers.
- Training and development programmes to ensure the workforce remains at the forefront of technological advancements.

3. Raw Materials:

- Costs of procuring high-quality metal powders and other essential materials used in manufacturing processes.

4. Intellectual Property:

- Costs associated with securing patents, trademarks, and other intellectual property protections.

Most Expensive Key Activities

1. Research and Development (R&D):

- Extensive investment in R&D activities to develop and refine advanced manufacturing technologies.
- Costs related to experimental trials, prototype development, and testing.

2. Production and Manufacturing:

- High costs of running advanced manufacturing facilities and maintaining production lines.
- Expenses related to process optimization, quality control, and meeting industry standards.

3. Sales and Marketing:

- Significant investment in building and maintaining a strong sales force.
- Marketing campaigns, participation in trade shows, and other promotional activities to generate leads and secure contracts.

4. Customer Support and Services:

- Providing ongoing technical support, training, and maintenance services to customers.
- Establishing and managing service centres and customer support infrastructure.

5. Regulatory Compliance:

- Ensuring products meet industry regulations and standards, particularly in highly regulated sectors like aerospace and hydrogen storage.
- Long qualification periods and the associated costs of achieving certification and compliance.

Revenue Streams

Customer Willingness to Pay

1. For What Value Are Our Customers Really Willing to Pay?

- Innovation and High Performance: Customers in high-stake industries such as aerospace, defence, and space exploration are willing to pay a premium for innovative, high-performance components that enhance their product capabilities.
- Cost Efficiency: Reduced production costs and lead times are highly valued, especially when combined with the assurance of maintaining high quality.
- Customization and Flexibility: The ability to produce bespoke, multi-material parts tailored to specific needs is a significant value proposition.
- Reliability and Durability: Customers are willing to invest in products that ensure reliability and longevity, critical for aerospace and defence applications.
- Sustainability: Solutions that contribute to environmental sustainability and reduce the carbon footprint are increasingly valued, particularly in the context of global regulatory trends.

2. For What Do They Currently Pay?

- Advanced Manufacturing Solutions: Payment for complex, high-performance parts produced through additive manufacturing techniques.
- Technical Support and Maintenance: Fees for ongoing technical support, maintenance, and training services.
- R&D Collaborations: Funding for joint research and development projects to develop new products or improve existing ones.
- Regulatory Compliance: Costs associated with ensuring that components meet industry standards and regulations.

Payment Methods

3. How Are They Currently Paying?

- Project Based Payments: Customers often pay on a project basis, where costs are defined by the scope and complexity of the project.
- Service Contracts: Regular payments under service and maintenance contracts, which ensure continuous support and periodic servicing.
- Milestone Payments: Payments tied to the achievement of specific milestones in product development or delivery schedules.
- Direct Purchases: Onetime payments for specific parts or components ordered.

4. How Would They Prefer to Pay?

- Flexible Payment Plans: Options for more flexible payment terms, such as instalment plans or deferred payments, especially for large, high-cost projects.
- Subscription Models: Regular subscription payments for ongoing access to support, maintenance, and updates.
- Usage Based Billing: Payments based on actual usage or performance metrics, which could be more attractive for clients seeking cost efficiency.
- Customizable Payment Terms: Tailored payment terms that align with the financial planning and budgeting cycles of the customers.

Revenue Streams

5. Revenue Stream Contributions to Overall Revenues:

Sales of Advanced Manufacturing Solutions: ~50 - 60%

- This includes revenue from the sale of bespoke, high-performance multi-material components, particularly to the aerospace, defence, and space sectors.

Service and Maintenance Contracts: ~20 - 25%

- Regular income from service agreements, maintenance, and support contracts.

R&D Collaborations: ~10 - 15%

- Joint development projects and collaborative research initiatives funded by customers.

Consulting and Training Services: ~5 - 10%

- Fees from providing expert consulting, training, and technical workshops.