Z - B R E 4 K

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Strategies and Predictive Maintenance models wrapped around physical systems for Zero-unexpected-Breakdowns and increased operating life of Factories

Z-BRE4K

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2nd Interim Plan for the Exploitation and Dissemination of Results (PEDR)

Work Package 8

Dissemination/Communication/Exploitation

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Executive Summary

Abstract	The present document will illustrate the beneficiaries' strategy and concrete actions related to the protection, dissemination and exploitation of the project results.
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Glossary of Acronyms

Acronym	Extended definition
PEDR	Plan for Exploitation and Dissemination of the Results
RTD	Research and Technological Development
IP	Intellectual Property
IPR	Intellectual Property Rights
OEM	Original Equipment Manufacturer
EFFRA	European Factories of the Future Research Association
ICT	Information and Communication Technologies
FoF	Factories of the Future
CMMS/EAM	Computerized Maintenance Management Systems/Enterprise Asset Management
EFNMS	European Federation of National Maintenance Societies
NMS.	National Maintenance Societies – 22 in different EU countries
GSMP	Gulf Society of Maintenance Professionals
SMRP	Society for Maintenance and Reliability Professionals
GFMAM	Global Forum of Maintenance & Asset Management
DEM	Dissemination and Exploitation Manager
TRL	Technology Readiness Level
GA	Grant Agreement
CA	Consortium Agreement

Acronym	Extended definition
KPI	Key Performance Indicators
PdM	Predictive Maintenance

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1 SUMMARY

The aim of Z-BRE4K project is to face the complexity of planning and controlling manufacturing production systems arising from the dynamism and unpredictability of the challenges posed by constant changes in customer demand and capabilities of available resource, by developing a **novel predictive maintenance platform to eliminate unexpected-breakdowns and extend the life of production systems**.

The Z-BRE4K solution comprises the introduction of **eight scalable strategies** at component, machine and system level targeting

(i) the prediction occurrence of failure based on evidences (**Z-PREDICT**),
(ii) the early detection of current or emerging failure (**Z-DIAGNOSE**),
(iii) the prevention of failure occurrence, building up, or even propagation within the production system (**Z-PREVENT**),
(iv) the estimation of the remaining useful life (RUL) of assets (**Z-ESTIMATE**),
(v) the management of the aforementioned strategies through event modelling, KPI (key performance indicators) monitoring and real-time decision support (**Z-MANAGE**),
(vi) the replacement, reconfiguration, re-use, retirement, and recycling of components/assets (**Z-REMEDIATE**),
(vii) the synchronization of remedy actions, production planning and logistics (**Z-SYNCHRONISE**),
(viii) the preservation of the safety, health, and comfort of human workers (**Z-SAFETY**).

To demonstrate the strategies mentioned above, the project envisages the implementation of three use cases, focusing on:

- the demonstration of a Lighthouse manufacturing process FRAMETOP for the multistage zero-defect manufacturing of next generation automotive chassis;
- a predictive platform for a production line with cold forming tooling;
- the introduction of a predictive maintenance service for the end user involved within compression molding machines.

This document is the second version (M24) of the **Plan for Exploitation and Dissemination of Results (PEDR) of Z-BRE4K** project. While, the contents of the first release included a general overview of the concepts of Communication, Dissemination and Exploitation in H2020 projects, the relative strategies and action plans that the consortium is meant to implement in order to promote the project, foster its results' knowledge and ensure their uptake for future business opportunities; this 2nd Interim PEDR will mainly analyze the strategies for the Communication, Dissemination and Exploitations of the results that have been produced by the Z-BRE4K consortium from Year 2 of the project, together with issues related to Innovation Management, the IPR Protection Strategy and the Knowledge Management Plan. This timing is coherent with project's planning, since the RTD work packages have been finish by M19, whereas the integration and testing (WP6) will mostly cover Y3 of Z-BRE4K project.

The present document is structured in three sections as follow:

- **PART 1: Communication and Dissemination Strategy.** This section comprises a brief introduction on the concepts of Communication and Dissemination and the fine line that distinguishes one action from the other in terms of objectives, focuses, target audience and formal obligations. The strategy to be deployed by the consortium for the promotion of the project and the dissemination of its results is duly outlined, starting from the identification of the stakeholders, going through the notification to stakeholders about Z-BRE4K benefits and progress in industrial end users, to finally engage the stakeholders with the project. Moreover, several sub-sections are dedicated to the description of the key messages that communication and dissemination action aim to transfer, the tools and the channel that will be used to deliver the messages.
- **PART 2: Exploitation.** The second section of the document contains the exploitation vision of Z-BRE4K project together with the guidelines that will constitute the basis for all the future exploitation activities. More specifically, this document provides a number of checklists allowing the characterization of the various exploitation results, identifying the "object" and the "target", as well as to sketch a first draft of suitable exploitation strategies, through the identification of potential "suppliers" and "means". Furthermore, while this first release of the PEDR contained a preliminary characterization of the exploitable results, this second version deepens that characterization and defines the suitable exploitation strategies.
- **PART 3: IPR Protection Strategy and the Knowledge Management Plan.** The third section of this document deals with Intellectual Property Rights, Foreground and Background IP and all the IP claims or IPR management issues on project results, thus regulating the management of project results for both internal consortium and external users.

The Plan for the Dissemination and Exploitation of Results will be constantly updated during the project to guarantee the quality of the implementation and several internal versions of the document will be reviewed by the project consortium. The final plan will be delivered by M42 and it will be the most critical and important deliverable for the impact of Z-BRE4K and the further exploitation of its results beyond the project lifetime.

2 PART 1: COMMUNICATION AND DISSEMINATION STRATEGY

Communication and dissemination activities play an important role to **increase the impact** of an H2020 project as both represent useful instruments to raise awareness of EU funding opportunities, explain the societal relevance of the research, support future research and innovation funding actions, facilitate the uptake of project's results with the aim of creating potential business opportunities for new products or services.

The boundaries between communication and dissemination are often blurry and sometimes overlap depending on the content to be transmitted and the target group addressed. The main aspects that differentiate these actions are their aim, focus, and target audience. While communication aims to create awareness of the EU initiatives, promote the project and its results to a differentiated f audience ranging from stakeholders and investors to the media and general public, dissemination is focused more on fostering the transfer of knowledge created within the project to make results available for other users. The target audience for a dissemination action is primarily represented by the scientific community, industrial partners and policymakers. In the following sub-sections, both the communication and dissemination strategies of Z-BRE4K project are detailed.

2.1 COMMUNICATION

2.1.1 Beyond the definition of Communication

The glossary of the European Commission Research & Innovation Participant Portal defines the Communication on a project a "*strategically planned process that starts at the outset of the action and continues throughout its entire lifetime, aimed at promoting the action and its results. It requires strategic and targeted measures for communicating about (i) the action and (ii) its results to a multitude of audiences, including the media and the public and possibly engaging in a two-way exchange*".

The **main objective** of communication is to reach out society, beyond the project own community, and promote the impact and benefits of the EU funded projects in a strategic and effective manner. For this reason, the choice of the proper language is fundamental in communication activities. Indeed, the language must be understandable by multiple audiences, included non-specialists. Besides project activities and tasks, communication actions must also convey the public policy perspective of EU research and innovation funding by addressing aspects such as:

- transnational cooperation in a European consortium – the benefits of working within a group that allows to achieve more than otherwise possible;
- scientific excellence – contributing to competitiveness and to solving societal challenges;
- impact on everyday lives – better use of results and spill-over to policymakers, industry and the scientific community.

Communication measures are **horizontal issues** that run alongside the duration of the project. However, compared to dissemination and exploitation that get momentum towards the end of the project and after its conclusion, when more concrete outcomes emerge, communication starts to be relevant from the project outset. This is mainly due to the aim of communication to inform the audience on the goals and the contents of the foreseen research activities and their expected impact rather than transfer the knowledge and results of the project.

There are some **guidelines** to follow to be effective when promoting project aspects:

- Communication actions must be strategically planned and not just be ad-hoc efforts;
- Communication objectives must be clearly defined before the action takes place, for example the expected impact, the reaction to be prompted;
- The language used to convey the contents and the contents themselves must be targeted and adapted to an audience that goes beyond the project's own community including the media and the general public;
- Communication action must convey a pertinent message that relates to the audience's everyday life and must be proportionate to the scale of the action, that is the number of beneficiaries involved and the available budget;
- The right medium and means must be chosen and deployed: working at a local, regional, national, EU-using one-way exchange (website, press release, brochure, etc.) or two-way exchange (exhibition, school visit, internet debate, etc.).

2.1.2 Z-BRE4K communication strategy

According to article 38 of the Grant Agreement "*The beneficiaries must promote the action and its results, by providing targeted information to multiple audiences (including the media and the public) in a strategic and effective manner.*

This does not change the dissemination obligations in Article 29, the confidentiality obligations in Article 36 or the security obligations in Article 37, all of which still apply".

The Grant Agreement clearly states the **obligation to communicate and promote project action** and to do so without breaching obligations of Article 29 on the dissemination of the results, reiterating the importance to take an integrated approach to carry out the communication together with dissemination activities to maximize the impact of the project.

Z-BRE4K's workplan is fully committed to communicate project's results and their benefits for the stakeholders to the widest possible audience. Z-BRE4K communication measures have five main milestones:

1. Preparing content, graphical identity and effective communication instruments:
    a. logo,
    b. web site,
    c. poster,
    d. presentation,
    e. press releases;

2. Producing marketing material and find communication channels to promote the project among the industrial stakeholders as well as audiences beyond the project's own community:
    a. pre-commercial brochure,
    b. newsletters
    c. videos
    d. Newspapers,
    e. Industrial magazines and journals,
    f. YouTube,
    g. Twitter,
    h. LinkedIn;
3. Promoting Z-BRE4K to all target groups in EU and beyond (publications, participation in relevant external events, organization of project events – thematic workshops and final conferences);
4. Collecting feedback from potential end-users and other target groups, thus facilitating Z-BRE4K tuning and improvements, as well keeping end users' requirements updated;
5. Reinforcing the brand-name of Z-BRE4K as a key-player in the IoT, physical asset management and maintenance market;
6. Raising awareness on Z-BRE4K philosophy to scientific and standardisation communities to make them supporters, thus enabling improvements, but also furnishing the future generation of users/clients.

The objective of Z-BRE4K communication strategy is to plan actions to maximize the impact of the project and to identify the proper promoting tools to raise public awareness about it, its expected results and progress to boost project's exploitation. To fulfil this ambition Z-Bre4k has taken a structured approach following a precise timeline split in **three main phases**:

- Phase 1 – Initial awareness (M1-M12) aims at agreeing upon communication strategy and future activities; creating initial awareness in markets related to Project's scope and objectives.
- Phase 2 – Targeted awareness (M13-M36) aims at informing targeted stakeholders and groups and target market about the technological breakthroughs and business benefits of Z-BRE4K.
- Phase 3 – Strategic phase (M37-M42) aims at maximizing target market and industry awareness regarding the Z-BRE4K platform and its exploitable products;

The Dissemination and Exploitation Manager together with other partners is expected to duly identify and profile the most relevant stakeholders and target groups at each stage of the communication strategy. Their favoured communication approaches and motivations for pursuing project results will then be analysed. More in detail, Z-BRE4K communication strategy targets **two different audiences** with different aims:

i. **Industrial stakeholders** such as end users, IoT and OEM technology providers and integrators, maintenance consultants. The strategy is aiming at creating technical and business interest in the opportunities created by the project's results;

ii. **Scientific and standardisation communities:** The strategy is aiming at highlighting Z-Bre4k validated results beyond the state of the art, incl. results with potential for contribution to standards.

The relevant events for project promotion are constantly updated and partners discuss and choose the most appropriate communicator for each event. The website provides up-to-date information about the project and a strong representation on relevant social media is ensured. Traditional channels such as newspapers and industrial magazines are also used. Publications are drafted and participation in relevant events is pursued, including the organization of Z-BRE4K thematic workshops and a final conference.

The following matrix summarizes communication support and actions and matches the targeted stakeholders' categories:

Figure 1. Communication plan

Communication Supports & Channels	KPIs	Target Stakeholders (✓=Main Target, ▯=Secondary)		
		R&D&I, Other Prof. Communit. (Groups-2,5)	End-Users (Group-1)	Facilitators (Groups-3,4)
Project documentation				
Leaflet	1 initial version + update	✓	✓	✓
Poster	1 initial version + update	✓	✓	▯
Reference PPT presentation	1 initial version + update	✓	✓	✓
Project publications				
Press releases	At least 2 per year	✓	✓	✓
Project newsletter	1 every 6 months	▯	✓	✓
Articles and proceedings	9 publications (1+3+3+2)	✓	✓	▯
Project deliverables	See list of deliverables	✓	▯	▯
Open access repository (RDR)	1 deposit per year	✓	▯	✓
Project videos (incl. YouTube presence)	4 for different commun. (1 initial version+update)	✓	✓	✓
Online presence				
Project website	1 website, monthly updated	✓	✓	✓
Related websites	10+	*Depending on specific website*		
LinkedIn	At least 1 monthly update	✓	✓	✓
Twitter	At least 2 monthly updates	✓	✓	✓
Events				
Presentation & feedback sessions	6	✓	▯	✓
Thematic workshops and other project events	Min 3 workshops + 1 final conference	✓	✓	✓
Participation at relevant External events	30+	*Depending on specific event*		

2.1.3 Z-BRE4K communication targets and message

The overall aim of Z-BRE4K communication activities is to ensure the reach-out of the society and promote the impact and benefits of EU funded projects in a strategic and effective manner. Therefore, communication actions target stakeholders and groups covering the full range of potential users in manufacturing value chains as well as industrial and ICT/FoF R&D communities. Each communication activity is tailored to the specific group and the message to be conveyed:

1. Manufacturing and process companies, Big ICT industries, Food & Beverage, Transport, Aerospace, etc.
2. Industrial research communities, EFFRA, ICT and FoF research communities; Standardization bodies.

3. Maintenance consultants and CMMS/EAM integrators; Suppliers/integrators of MES systems.
4. EFNMS (**European Federation of National Maintenance Societies**) and NMS (**National Maintenance Societies – 22 in different EU countries**).
5. Other international societies and umbrella organizations, such as GSMP (**Gulf Society of Maintenance Professionals**), SMRP (**Society for Maintenance and Reliability Professionals**). GFMAM (**Global Forum of Maintenance & Asset Management**) are also an important stakeholder (**participation of USA, Canada, Brazil, Australia, and Middle East maintenance societies***).*

The main message that Z-BRE4K communication actions aim to deliver are:

- project scope,
- project progresses and activities,
- outcomes and results,
- updates on project meetings,
- news on events attended by the project beneficiaries where Z-BRE4K was promoted.

2.1.4 Communication Channels

There is a wide variety of communication methods and channels. The challenge is to select the right one(s) to bring the right message to the proper target audience and achieve the project's purpose. The following table lists the **channels** used to make the Z-BRE4K communication strategy effective, highlighting the scope of the action for each channel.

Table 1 Communication channels

CHANNEL	SCOPE
Brochures	▪ Awareness
Website	▪ Awareness ▪ Information ▪ Promotion
Social network profiles	▪ Information ▪ Promotion ▪ Involvement
Printable manual	▪ Awareness ▪ Information ▪ Promotion
Posters	▪ Information ▪ Promotion

2.1.5 Communication Tools

- Logo and templates

A specific logo has been created for the project by a professional graphic studio. This logo symbolizes: The "**Z**" stands for zero, while the "**4**"is intended to play with the letter "A" which look similar (as "O" with "0" and "I" with "1"). There is an extra meaning on number "**4**" as it indicates also the Industry 4.0.

Figure 2. Z-BRE4K logo

Following the creation of the logo we set all the Word and PowerPoint templates so that all the colours, logos, and information about the project are displayed. All the templates report also the **EU flag and details of the European Union's program under with Z-BRE4K** was financed.

- Website

The website is online as of January 2018 at the address:

https://www.z-bre4k.eu/

the Z-BRE4K website is primarily intended as a **window to promote the project** purpose, strategies, activities and the outcomes of the research.

Describing what the plans of the project consist in and how the funding provided by the EU are used is not the only objective of the website. Indeed, it should also act as an aggregator of news and events that are related to the topic of predictive maintenance, which may raise the interest of the visitors and increase the public knowledge of this matter.

The website also acts as an aggregator of news and events that are related to Industry 4.0 and could be interesting for the visitors. Each partner is required to give the highest visibility to the website, linking it to their institutional websites, disseminating it among their networks and referring to it in any communication concerning the project. The Z-BRE4K website is indicated in all communication templates circulated by the dissemination.

The information on the website will grow with the proceedings of the project. Each event and achievement will be disseminated to the public via social networks and website.

- Social networks

Social Media are currently the best way of diffusing information with a better visibility than a single website. Therefore, we plan to use both LinkedIn and Twitter as social network for promoting the Z-BRE4K project. The social media accounts are constantly updated with relevant news on project activities and events.

TWITTER

A Twitter account has been created together with the mention @z_bre4k. This account is useful both for promoting the activities carried on by the consortium and for diffusing external information relevant to the project. All partners have connected their account to the Z-BRE4K Twitter account and are currently re-twitting Z-BRE4K's messages.

LINKEDIN

A LinkedIn account has been created too. Through this account, we plan to connect all the people involved in Z-BRE4K and to promote the results of the project to all their contacts.

- Public web communications and promotional materials

The WP8 leader prepares press releases in collaboration with partner organisations and the coordinator to raise awareness and disseminate information about the project. Press releases are disseminated through the partners' network and press contacts.

  - A first version of the **brochure** illustrating Z-BRE4K project has been printed. It focuses on the strategies that Z-BRE4K will deploy to obtain the predictive maintenance platform.
  - **Posters and rollup**: A rollup has been created to support the participation to fairs and events.
  - **Video**: A professional video maker company will be hired to realize a promotional video about the results obtained within the project. This video will be uploaded on the website and social media pages and will be promoted by all partners.

2.2 DISSEMINATION

2.2.1 Beyond the definition of Dissemination

The article 29 of the Annotated Model Grant Agreement clearly states that "*each beneficiary must 'disseminate' its results by disclosing them to the public by appropriate means (other than resulting from protecting or exploiting the results), including by scientific publications in any medium*".

The article not only states an obligation but provides also the definition of dissemination that in wider terms means "spreading something, especially information, as far as possible". As previously mentioned, the fine line between communication and dissemination actions is often a blurry boundary that sometimes fades depending on the content to be transmitted and target group.

Compared to communication, dissemination activities are more focused on results and solutions deriving from a project. Thus, the objective is not only to create awareness, but also to describe the results and the solutions to ensure understanding and enable others to use and take up results. Scientific communities, industrial partners and policymakers are the audiences addressed by dissemination activities since they are considered the most interested in the use of the solutions provided by the project.

Therefore, the goal of transferring knowledge and results to the ones that can best use them makes the dissemination a key activity to maximize the impact of a project: it ensures the possibility to use the project outputs beyond the lifetime of the project and to broaden their value compared to the original focus.

There are several benefits deriving from a good dissemination strategy:

- Enhanced **visibility** of the project research line and drawing the attention of potential users on the project outputs;
- The gain in **credibility** within the scientific community and so the possibility to find new additional funding sources or to join new consortia;
- Occasion to learn novel approaches and solutions thanks to the **exchange of knowledge** on all levels and the cross-fertilization of ideas.

2.2.2 Z-BRE4K dissemination strategy

The main objective of Z-BRE4K dissemination plan is to identify and plan the activities to be performed to transfer the findings and the results of the project and develop a response mechanism between the consortium and the various stakeholders to maximize the impact of Z-BRE4K. More in detail, this translates in a series of milestones to be met:

- the creation of **public awareness** on the project,
- the **generation of interest** within the scientific community,
- the direct **involvement of stakeholders** that can facilitate market up-take of research results.

The Dissemination manager isn't the only one involved in the dissemination actions. To ensure the effectiveness of the strategy and the accomplishments of the fixed goals, dissemination is meant to be performed both as a collective activity managed by the entire consortium and, at the same time, as an individual set of actions carried out by each single partner at the local level. Z-BRE4K members comprise both industrial and RTD partners who are well-established organizations that constitutes a natural channel for the dissemination of the project and its results to other potential users. Z-BRE4K dissemination actions rely on the yearly experience,

know-how and expertise of its members to ensure that projects' output will have the necessary exposure to guarantee their utilization after the project is concluded.

The direct involvement of all the partners guarantees an effective communication within the consortium as well as timely information on the project progresses.

The plan for the dissemination activities is an iterative process that started from the outline of the Description of Action, went through the kick-off meeting discussions and will be constantly updated over the full duration of the project. The Dissemination strategy is drawn up in accordance with the development stage of the project outputs:

a) **Phase 1 (M1-M12)**: in this phase dissemination activities are oriented to the identification of interesting information sources and dissemination opportunities.
b) **Phase 2 (M13-M36):** the consortium attends events of interest to disseminate preliminary project results and to start creating awareness and generating the interest of possible stakeholders.
c) **Phase 3 (M 37-M42)**: this phase is focused on the dissemination of findings and results to a more targeted audience to facilitate the market take-up of research outputs.

In line with Phase 2 of the Dissemination Strategy and with the aim to fulfill dissemination and communication purposes, a constant search and further creation of a list of events and conferences that could be relevant to Z-BRE4K members and results has been performed form Year 2. This list is monitored and periodically updated and shared with the members throughout the whole period.

The most significant dissemination activities will be carried out as the final research results will be achieved and addressed to the industrial development stage.

Z-BRE4K dissemination actions not only comply with Article 29.1 of the Grant Agreement but also with Section 8.4 of the Consortium Agreement that specifically regulates the dissemination of owned (or jointly owned) results restricted to publications and presentations as follow "Prior notice of any planned publication shall be given to the other Parties at least 30 calendar days before the publication.

Any objection to the planned publication shall be made in accordance with the Grant Agreement in writing or by email to the Coordinator and to the Party or Parties proposing the dissemination within 15 calendar days after receipt of the notice. If no objection is made within the time limit stated above, the publication is permitted".

Besides the basic regulations within the Consortium Agreement and Grant Agreement, Z-BRE4K dissemination management follows the **best practices** suggested by the EC Guidelines as well as the **practices** deriving from the well-established experience of the partners in other research projects:

- All the partners involved in the research activities will be made aware about the final results of the project and the implications resulting from the outputs like publications and presentations.
- All the scientific articles on the results of the project will be duly reviewed by the relevant partners involved in the development of the topic of the publication.
- All the articles and publications on project outputs will be shared within the consortium before the date of disclosure.
- All the partners should contribute to the dissemination according to their role and effort by participating and giving presentations at conferences, workshops, meetings, by publishing papers, holding press conferences, networking and similar activities.
- The Dissemination and Exploitation Manager (DEM) is the reference and contact point for every dissemination action. He/she is in charge to constantly verify the quality of the contents to be shared, to ensure the correct implementation of the project results and the consistency between the events to be attended by the partners and the purpose of the dissemination activity.
- All public results will be accessible from the project website and usable from all parties who may benefit from them to maximize the impact of the project.

To ensure the effective fostering of Z-BRE4K knowledge, the deployment of the dissemination strategy will consist in the identification of the following **milestones**:

- The topic and message of the dissemination action (the contents that will be shared);
- The target audience (who are the stakeholders to be addressed and that may have more interest for the topic);
- The messenger (the messenger should be a credible spokesperson who is expert of the subject to be disseminated);
- The methods and tools (the transfer method should be carefully considered depending on the nature of the event: the size of the audience, the background of the participants and the location);
- The expected outcome (the impact to be achieved and the purpose of the dissemination must be defined to optimally deliver the message).

2.2.3 Dissemination and Confidentiality

The dissemination activities are deeply entangled with the matter of Intellectual Property Rights Protection since data and results belonging to the background and foreground of the project partners may be disclosed. Section 8 and 10 of the CA and Article 29.1 and 36 of the GA state and rule the connection between dissemination actions and confidentiality.

The main aspects of IP rights protection are the following:

- The creation, within the consortium, of a common understanding and awareness between the academic world and the industrial partners of the different interests and motivations to publish project sensitive to avoid undesired breach of confidentiality among the partners. The willing of academic partners to publish is driven by its

commitment toward the scientific community while industrial partners' decision is led by commercial considerations.

- The signing of common agreement on publication of confidential information or any other information subjected to the IP rights of one of the partners.
- The establishment of a set of rules and procedures to avoid the violation of the IP rights and to regulate the publication of data on project results.

Article 29.1 of the GA states that "*A beneficiary that intends to disseminate its results must give advance notice to the other beneficiaries of — unless agreed otherwise — at least 45 days, together with sufficient information on the results it will disseminate. Any other beneficiary may object within — unless agreed otherwise — 30 days of receiving notification, if it can show that its legitimate interests in relation to the results or background would be significantly harmed. If a beneficiary intends not to protect its results, it may — under certain conditions (see Article 26.4.1) — need to formally notify the Commission before dissemination takes place*".

Moreover, Article 36 of the GA reports "*During implementation of the action and for four years after the period set out in Article 3, the parties must keep confidential any data, documents or other material (in any form) that is identified as confidential at the time it is disclosed ('confidential information')*".

In order to avoid any breach of confidence, no one within the consortium is allowed to publish any contents involving other partners' foreground, background or confidential data during and beyond the lifetime of project without the written approval of the parties involved. In case of disclosure of jointly owned results, each owner must be asked for its approval to publish without any possibility to withhold such consents.

All draft articles and publications must be reviewed by the Project Coordinator, the Project Manager and by the Dissemination and Exploitation Manager before publication or production for reporting and archiving purposes. They will check the fulfilment of the dissemination requirements and if there is any already available prior art. Moreover, they will evaluate the possibility to make the contents available on Z-BRE4K website or not.

Furthermore, the Open Access policy requirements need to be verified, and eventually, further negotiated with the organizers of Dissemination Events (i.e.: Conferences, Symposiums, Congresses) where Z-BRE4K RTD activities' results are disseminated, so the Grant Agreement of the Project is respected by publishing an open access version of the publication.

Further information on IP Rights and their management within the project can be found in Chapter 4.1.

2.2.4 Dissemination Channels

To be efficient in pursuing Z-BRE4K dissemination strategy, the consortium has identified the main channels to transfer the knowledge and the outcomes of the project:

Table 2 Dissemination channels

CHANNEL	SCOPE
Trade fairs and conferences	▪ Involvement ▪ Promotion
Cluster	▪ Involvement ▪ Promotion
Conferences	▪ Involvement
Workshops	▪ Involvement
Journal articles	▪ Information

Cluster events represent a useful channel for disseminating the knowledge produced during a project since they allow to reach widely scientific communities and industrial partners that could have a direct interest in project progresses and results. A list of relevant regional, national and European Cluster events is constantly updated. Indeed, partners were asked to list the clusters they belong to and the events they wish to attend.

It follows a list of events Z-BRE4K partners took part in:

CLUSTER EVENTS				
Event	**Date & venue**	**Partner involved**	**Publication/content**	**Name**
I-ESA 2018 (Interoperability for enterprise systems and applications)	21/03/2018, Berlin (Germany)	Holonix, EPFL	Conference Article	Maintenance planning support tool based on condition monitoring with semantic modelling of systems
IFIP International Conference on Advances in Production Management Systems APMS 2018 Advances in Production Management Systems. Smart Manufacturing for Industry 4.0	August 2018, Seoul (Korea)	EPFL, Core Innovation, Atlantis	Conference Article	Predictive maintenance platform based on integrated strategies for increased operating life of factories
FoF Automotive Sector workshop	27/02/2018, Brussels (Belgium)	CRIT. AIMEN	Presentation	
Data Value for the Enterprises	08/05/2018, Vignola (Italy)	CRIT	Presentation	
NAXOS 2018, 6th International Conference	2018, Naxos (Greece)	Brunel University	Poster	A novel predictive

CLUSTER EVENTS				
Event	**Date & venue**	**Partner involved**	**Publication/content**	**Name**
on Sustainable Solid Waste Management				maintenance platform to eliminate unexpected-breakdowns and extend life of production systems
2018 Aerospace Big Data Europe	28/10/20118, London (UK)	Brunel University	Panel Session	Why data control remains buring topic for the aftermarket?
PROPHESY Project Workshop on Predictive Maintenance	24/01/2019, Philips Drachten, (the Netherlands)	CRIT, Atlantis, IMEC Brunel, Fraunhofer	Presentation	
Machine Learning Conference Prague 2019	22/02/2019, Prague, (Czech Republic)	AIMEN	Poster	Real-time arc welding process monitoring using Deep Learning on an IoT OPC UA device
International Conference on Production Research	08/09/2019, Chicago, (USA)	Fraunhofer IAO	Paper	Approach for a holistic predictive maintenance strategy by incorporating a digital twin
ICPRAM2019, the 8th International Conference on Pattern Recognition Applications and Methods	19/02/2019, Prague, (Czech Republic)	IMEC	Paper	Eliminating Noise in the Matrix Profile
ACDL 2019: 2nd Advanced Course on Data Science & Machine Learning	15/07/2019, Siena (Italy)	IMEC	Poster	Matrix profile and machine learning for predictive maintenance
IoT Stream for Data Driven Predictive Maintenance	16/09/2019	Atlantis, Philips	Paper	Event-based predictive maintenance on top of sensor data in a real Industry 4.0 case study

Below, these events have been classified according to the dissemination tool that has been presented on the occasion (publications, posters, presentations and others).

2.2.4.1 ForeSee Cluster (FoF-09-2017)

Additionally, Z-BRE4K participates together with the rest of the FoF-09-2017 projects in the ForSee cluster (namely SERENA, PRECOM, PROGRAMS, PROPHESY and UPTIME), which aims to raise a wider awareness than FoF-09-2017 projects itself, joining efforts. The ForeSee cluster is led by the SERENA project coordinator, Sotiris Makris, of the LMS at the University of Patras and is active in 6 Working areas, each of them led by one project as follows:

- AA1: Analysis of technology in the market and in the pipeline [led by PROPHESY project]
    - Reference model for compiling existing technology
    - Analysis of existing approaches
- AA2: ForeSee predictive maintenance concept for the Factory of the Future [PROGRAMS]
    - Scientific and technological aspects identification-clustering
    - Common reference model - generalisation
- AA3: Trend-setting for the future factory [Z-BRE4K]
    - The new factory approach on predictive maintenance
    - Key indicators for predictive maintenance applications
    - Standardisation aspects
- AA4: New model for sustainable factories through efficient predictive maintenance [led by PRECOM project]
    - Business model elaboration
    - Regulatory aspects
    - Ownership of raw equipment data – manufacturing process data, etc
- AA5: Skills building paradigm for predictive maintenance [led by SERENA project]
    - Education and training methods on the new predictive maintenance methods and platforms
    - Roadmap and future trend for the industry
- AA6: Community building and dissemination [UPTIME]
    - Cluster positioning, Communicating with other clusters
    - Web presence, web page, social media

The ForeSee cluster meets via telco periodically, roughly every two-months, and has already taken part into three dissemination events altogether, namely the ForeSee Cluster Workshop on Predictive Maintenance organized by the PROPHESY project at PHILIPS facilities in Drachten (January 24, 2019), the FoF Community Day 2019 (May 22-23, 2019), in which the ForeSee cluster introduced the key findings of each project and the cluster approach to develop a roadmap for predictive maintenance and the KET4DF Workshop (Rome, June 6, 2019, The 1st international workshop on Key Enabling Technologies for Digital Factories within CAISE 2019 Conference).

2.2.5 Key messages: the project outcomes

Once the main objectives of the project with its expected results and their benefits and significance for the target audience have been considered and the aim and objectives for the dissemination plan have been developed, the key messages for the dissemination need to be identified. As already reported within the document, Z-BRE4K dissemination activity will be focused on the project outcomes to foster the knowledge behind the results and make them available for others to use.

Key messages can be expressed in a single statement or in a series of statements. They are important because they help to focus on what is being disseminated, thereby they reduce the possibility of mixed messages.

When developing key messages, it is important to keep in mind:

- The audience's current awareness, knowledge and attitudes towards the issue.
- The response expected from the target audience/s (e.g. are you educating or informing, seeking to change attitudes or behaviors?).
- The benefits offered, and their significance.

It is also important to recognize that there is a limit to the number of messages which can be communicated, and often a trade-off between the number and complexity of key messages and the level of uptake achieved. The message is the extreme synthesis of what the project wants to communicate, or rather the essential core of the contents or line of reasoning that should, in any case, be learned and remembered by the receiver: everything, in the communication, must contribute to getting it through to the public. Messages should be based on what that audience wants to know, rather than on what they should hear. The style and content should be tailored for each audience. In order to be effective, the message must consider the objectives but, above all, the public's needs. Good communication strategies should always have key messages to be delivered in a campaign. The messages must be short, but at the same time capture the essential themes of a promotion or an intervention.

Particular attention should be given to possible incomprehension or misunderstandings. In fact, the message must be brief and clear, but not generic. In defining the message, it is important to make an effort to go beyond the initial hypotheses that come to mind, remembering above all who you are addressing.

2.2.6 Dissemination Tools: Scientific Articles

In order to reach the scientific community Z-BRE4K consortium promotes scientific paper publication and project presentation at scientific conferences targeting relevant domains for the project. The expected impact of presentations at this kind of events is very high because of the attendance of scientists and industrial stakeholders.

In addition to the pure scientific papers, the results and impacts of Z-BRE4K project will be communicated to professional, end-users and industries through papers in technical bulletins and sectorial journals.

Z-BRE4K has disseminated its progress through different scientific publications, gathered in the table below.

Table 3 Z-BRE4K List of publications

PUBLICATIONS				
Title	**Authors**	**Type**	**Event**	**Year**
Maintenance planning support tool based on condition monitoring with semantic modelling of systems	Alice Reina, Sang-Je Cho, Gökan May, Eva Coscia, Jacopo Cassina Dimitri Kiritsis	Conference Article	I-ESA 2018 (Interoperability for enterprise systems and applications)	2018
Predictive maintenance platform based on integrated strategies for increased operating life of factories	Gökan May, Nikos Kyriakoulis, Konstantinos Apostolou, Sangje Cho, Konstantinos Grevenitis, Stefanos Kokkorikos, Jovana Milenkovic, Dimitris Kiritsis	Conference Article	IFIP International Conference on Advances in Production Management Systems APMS 2018 Advances in Production Management Systems. Smart Manufacturing for Industry 4.0	2018
Eliminating Noise in the Matrix Profile	Dieter De Paepe, Olivier Janssens and Sofie Van Hoecke	Paper	ICPRAM2019, the 8th International Conference on Pattern Recognition Applications and Methods	2019
Approach for a holistic predictive maintenance strategy by incorporating a digital twin	Andreas Werner, Nikolas Zimmermann, Joachim Lentes	Paper	International Conference on Production Research	2019
Event-based predictive maintenance on top of sensor data in a real Industry 4.0 case study	Athanasios Naskos, Georgia Kougka, Theodoros Toliopoulos, Anastasios Gounaris, Cosmas Vamvalis, and Daniel Caljouw	Paper	IoT Stream for Data Driven Predictive Maintenance	2019
Implications of Z-Normalization in the Matrix Profile	Dieter De Paepe, Diego Nieves Avendaño, Sophie Van Hoecke	Book Chapter	Springer Book of ICPRAM 2019	2019

PUBLICATIONS				
Title	**Authors**	**Type**	**Event**	**Year**
The Digital Shopfloor: Industrial Automation in the Industry 4.0 Era	J. Soldatos, O. Lazaro, F. Cavaldini	Book Chapter		2019
Approach for a holistic predictive maintenance strategy by incorporating a digital twin	Nikolas Zimmermann, Fraunhofer IAO	Paper	25th International Conference on Production Research ICPR 2019	2019

Dissemination activities through poster exposition during conferences is gathered in the table below.

Table 4 Z-BRE4K List of posters

POSTERS			
Title	**Authors**	**Event**	**Year**
A novel predictive maintenance platform to eliminate unexpected-breakdowns and extend life of production systems	Ali Mousavi, Margarita Razgon, Veerenda Angadi, E. Katsou	NAXOS 2018, 6th International Conference on Sustainable Solid Waste Management	2018
Real-time arc welding process monitoring using Deep Learning on an IoT OPC UA device	Roi Mendez	Machine Learning Conference Prague 2019	2019
Matrix profile and machine learning for predictive maintenance	Diego Nieves Avendaño, Sofie Van Hoecke, Dirk Deschrijver	ACDL 2019 : 2nd Advanced Course on Data Science & Machine Learning	2019
Real-time arc welding process monitoring using Deep Learning on an IoT OPC UA Device	Roi Mendez, Veronica Panadeiro, Carlos Gonzales, Adrian Pallas	Machine Learning Prague 2019.	2019

Z-BRE4K dissemination through oral presentations is shown in the table below.

Table 5 Z-BRE4K List of presentations

PRESENTATIONS				
Title	**Authors**	**Event type**	**Event**	**Year**
Data Value for the Enterprises	Diego Barolomé	Seminar/ Workshop	Z-BRE4K Project Presentation	2018
Z-BRE4K Project Presentation	Enrico Callegati, Margherita Animini	Workshop	FoF Automotive Sector workshop	2018
Z-BRE4K project presentation and technical activities update	Nicola Raule, Veer Angadi, Thanasis Naskos, Andreas Werner, Diego Nieves Avendaño	Workshop	PROPHESY Project Workshop on Predictive Maintenance	2019

Other dissemination actions Z-BRE4K performed not included in the tables above are gathered below.

Table 6 Z-BRE4K List of other dissemination actions

OTHER DISSEMINATION ACTIONS				
Title	**Authors**	**Event type**	**Event**	**Year**
Why data control remains buring topic for the aftermarket?	Ali Mousavi	Panel session	2018 Aerospace Big Data Europe	2018
Z-BRE4K exploitation activities	Jovana Milenkovic	Fair attendance	8th International Exhibition on Nanotechnologies & Organic Electronics & Nanomedicine	2019

3 PART 2: EXPLOITATION

3.1 Exploitation vision

According to the European Commission glossary, Exploitation is defined as "*The utilisation of results in further research activities other than those covered by the action concerned, or in developing, creating and marketing a product or process, or in creating and providing a service, or in standardisation activities*."

This deliverable has already pointed out that **communication**, **dissemination** and **exploitation** are **different activities** taking place on a common playground: the results of the project. The concept standing behind the definition of exploitation, which is also the ultimate feature of the activity itself, is indeed the **effective and concrete use of the achieved project outcomes**.

The exploitation aims at using Research and Innovation actions to create a **concrete impact** for the society, with the expectation that the exploitable results will be used beyond the lifetime of the project.

Task T8.1 is addressed to write the Plan for the Exploitation and Dissemination of the Results. Thus, the deliverable related to this task is intended as a report of all the activities performed through the journey of exploitation: starting from the identification and characterization of the project results, going through the formulation of an exploitation strategy and the management of the IPR, to finally end with the identification of the market opportunities and the active stakeholder involvement.

The H2020 program defines project outcomes as "Any tangible or intangible output of the action, such as data, knowledge and information whatever their form or nature, whether or not they can be protected, which are generated in the action as well as any attached rights, including intellectual property rights."

To be successful in writing the exploitation plan it is essential to **start with the identification and characterization of the exploitable results**. Indeed, not all of what has been achieved throughout course of the project is likely to have an exploitation route. Exploitable results are only those having a potential scientific, economic and social significance. During the project these outcomes provide a mechanism to **capture and quantify impact**, while, by the end of the project, a way to **achieve impact** beyond project's completion.

The identification of the exploitable results is an ongoing process that starts at the proposal stage, when a preliminary list of expected results is outlined. Some of the foreseen outputs become available throughout the course of the project, some towards the end, some may result not to be feasible, some new outputs may be identified. Therefore, it is of outmost importance to **closely monitor project progresses** to capture the results and to identify outcomes not foreseen at the beginning of the project, to **follow up and manage** them through the whole lifetime of the project.

Therefore, by transitive property, the Plan for the Exploitation and Dissemination of the Results is an evolving report that will be periodically updated according to the emerging results of the project, the changes in the stakeholders or work context and their potential use during the project lifetime.

When shaping the outcomes of the project, it is mandatory to think out of the box: contrary to common belief, exploitable results do not necessarily correspond to a product or a service. There are six categories from which exploitable results may belong to:

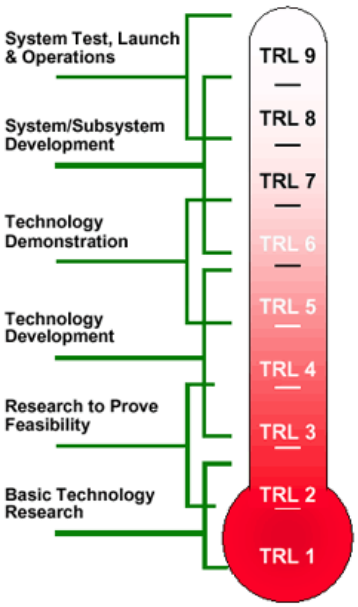
- **Equipment** – the machinery or tools needed to carry out a job; a set of physical tools, devices, kit assembled for a specific purpose.
- **Processes –** A systematic series of mechanized or chemical operations that are performed in order to produce something**.**
- **Products –** something that is made to be sold, usually something that is produced by an industrial process (as a custom but may be personalized upon request).

- **Services** – offering the above products, processes, equipment, or knowledge as a help to perform a work.
- **Knowledge & IP** – understanding of or information about a subject that you get by experience or study, either known by one person or by people generally
- **Other forms of knowledge** – Platform, publications, patent….

A **systematic approach** to the characterization of the exploitable results provides for **reference points** and **benchmarks** related to the innovation levels and technology readiness.

For this purpose, this assessment will use the **Technology Readiness Level (TRL)**[1] tool, a powerful method that estimates the technology maturity of the project results.

Figure 3. TRL methodology



The TRL tools may not apply to all kinds of exploitable results coming from Z-BRE4K project. However, it is a helpful instrument for managing the progress of research and development activities since it provides a measure of the current readiness of the exploitable results and a common understanding of their technology status.

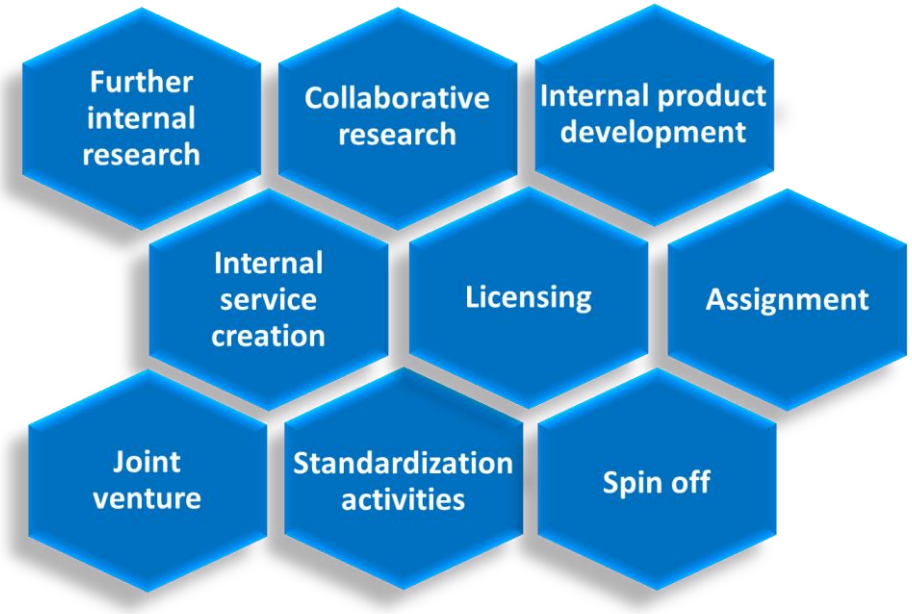
Turning innovation actions into concrete value and impact for society is also a matter of **thinking ahead**. Nevertheless, identifying, shaping and classifying the exploitable results coming from the project do not ensure their use beyond the lifetime of the project.

To **provide a future to project outcomes**, it is of outmost importance to have a **clear vision** for their exploitation and a **customised strategy** to follow depending on the nature of the results.

[1] European Commission (2017), H2020 Work Program 2018-2020, General Annexes, Annex G, Technology readiness levels (TRL), https://ec.europa.eu/research/participants/data/ref/h2020/other/wp/2018-2020/annexes/h2020-wp1820-annex-g-trl_en.pdf

Depending on the TRL reached, there are several routes for carrying out further exploitation, which are presented in the figure below:

Figure 4. Exploitation visions



The market uptake of the results of the project often requires further activities and considerable investments, which might not be encouraging unless outcomes are well protected through **intellectual property**. During a H2020 project, each partner of the consortium might be called to share his knowledge, experience and technological innovations to finalize the project idea. This means that the participants might contribute with some tangible and non-tangible assets giving rise to intellectual rights, that need to be protected through confidentiality agreements between the applicants.

A good plan for exploitation and dissemination of the results must state how the results and the relative intellectual property rights arising within the project will be protected. Intellectual property is in this way a cornerstone for an effective impact of research results in society.

3.2 Z-BRE4K Exploitation guidelines

The plan for the dissemination and exploitation of Z-BRE4K consortium follows a strategy based on:

1. The establishment of IP provisions within the consortium agreement (CA).

Regarding the ownership of the results, within the CA it is stated that results are owned by the partner who generated them. In case of an invention generated by more than one partner, they shall have the joint ownership of the work carried out and shall establish a separate joint ownership agreement regarding the allocation of ownerships and terms and conditions for the protection, dissemination and exploitation of the result. However, until the joint ownership

agreement has been signed, the results shall be jointly owned in shares according to their state of contribution. Specifically:

- regarding exploitation, each of the joint owners shall be entitled to use their jointly owned Results on a royalty-free basis, and without requiring the prior consent of the other joint owner(s);
- regarding licensing, each of the joint owners shall be entitled to grant non-exclusive, non-transferable licenses to third parties, without any right to sub-license, without obtaining any consent from the other joint owner(s) under the jointly owned Result and under any IPRs protecting such result;

2. A systematic and harmonized description of the Exploitable results coming from the project.

The systematic description of the exploitable results shall be the result of the consultation and reflection among the partners and of an analytical process of screening of those, of all the project outcomes, that potentially create revenues and/or provide social benefits.

As a first step, partners are called to actively participate in the identification and characterization of their own exploitable results by answering to the following points:

- Name of the exploitable result?
- What problems are solved?
- What is the new element of the result that distinguishes it from the state of the art?
- How better is the solution (faster, cheaper, more reliable, more efficient, with less undesired effects)?
- Who will use the result?
- Why should the end users invest in or adopt the result?
    - Further Internal Research (thus research activities must be beyond the project)
    - Collaborative Research (the results used as background of future collaborative research projects)
    - Internal Product Development (results used in developing, creating and marketing a product/process)
    - Internal Service Creation (results used in creating and providing a service)
    - Licensing (results exploited by other organisations by through-out licensing)
    - Assignment (results exploited by other organisations by the transfer of ownership)
    - Joint Venture (results used as background of a joint venture)
    - Spin-off (a separate company established in order to bring to the market technology resulting from the project)
    - Standardization activities (results used either to develop new standardization activities, or to contribute to ongoing standardization work
- What are the stakeholders to be involved to achieve your exploitation vision?
- Do you expect to have reached a TRL higher or lower than TRL7 at M42?
- What are the expected steps in your go-to-market strategy?
- Who is/are your main competitor(s)?

- Who are the partners involved in the result?
- Did you protect, or will you protect this result? How? When?

The feedback collected from project partners shall be matched with the list of the expected exploitable results outlined in the Grant Agreement. The most relevant and promising outcomes in terms of social and economic impact shall be further developed and exploited trough the implementation of targeted exploitation actions to support partners' go-to-market strategy.

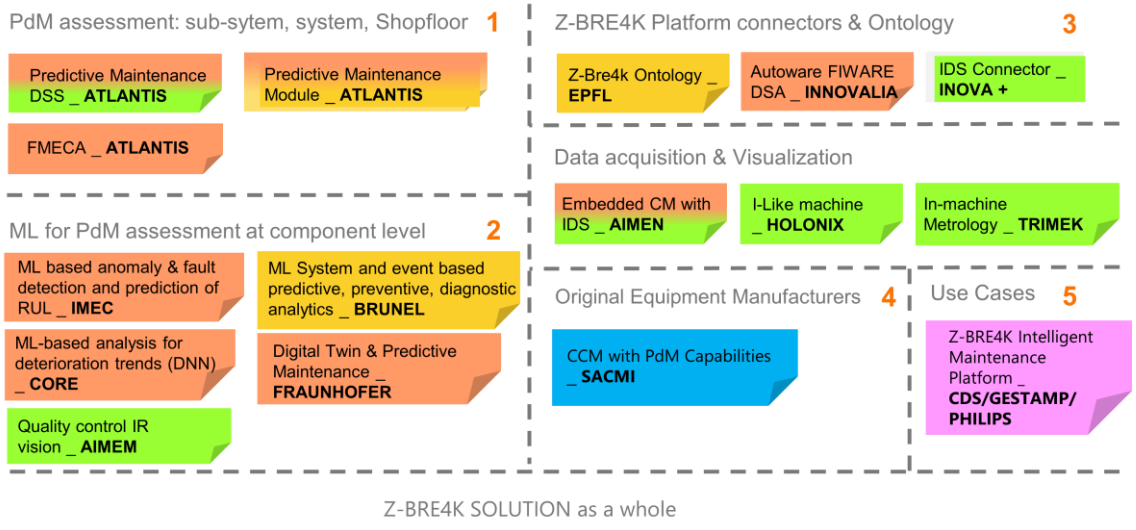
3. A shared process to define the IP Claims on the exploitable results.

The plan for exploitation reports the previous agreement in terms of organization and management of the results. Moreover, moments of discussion and reflection among the partners shall lead to draw up a strategy to define how the results that are capable of, or reasonably expected to be capable of, commercial or industrial exploitation might be protected from their early disclosure. It shall be stated how ownership and access rights between the project partners will be organized, including any economic conditions. Joint ownership should be considered. Applicants shall mention whether, in a case of jointly owned results, they might reach an agreement for the effective management of such results with details.

3.3 Z-BRE4K Exploitable results characterization

During year 1 of Z-BRE4K, project partners have carried out a preliminary characterization of exploitable results. The following chart shows a summary of how the exploitable result grouping and characterization:

Figure 5 Grouping and characterization of Z-BRE4K's exploitable results



The results to the interviews for the characterization of Z_BRE4K's individual Exploitable Results can be found in **Appendix I – Results of interviews** of the present document.

3.3.1 Z-BRE4K PLATFORM SOLUTION

The result "Z-BRE4K platform", as a joint solution of the project consortium, was investigated and characterized during the workshop held during the 4th periodic meeting of the project. Z-BRE4K partners divided into 4 groups to perform a Business Model Canvas on the project integrated suite, a platform allowing users to predict the occurrence of failure of machines or components, the early detection and prevention of failure, the estimation of the remaining useful life of assets, the management of these strategies, the re-use or reconfiguration of assets, the resynchronization of remedy actions and the preservation of the workers' health. This time, groups focused on two "segments": Value Propositions and Customer Segments. Three groups, formed mostly by technology providers, worked on the Value propositions segment, while the 4th group formed by end-user partners and an original equipment manufacturer (OEM) focused on Customer Segments.

Value Propositions (VP)

The value propositions segment describes the bundle of products and services that create value for the customer as they help them solving a problem or satisfy their needs.

Groups working on VP focused on five questions:

- What is Z-BRE4K integrated suite?
- Assess, adjust and confirm the Z-BRE4K value proposition
- Who is the intended user of Z-BRE4K?
- Which parts are offered as extra features?
- Which information can the user access and how?

Group tried to understand what Z-BRE4K integrated suite is and they ended up defining it as a maintenance platform which must be:

- scalable, modular, placed in premises or on cloud and able to provide virtual assistance (Group 1);
- predictive and prescriptive, by using predictive algorithms/ capabilities and preventive actions assigned for each predictive failure (Group 2);
- tailored and secure, in order to optimize maintenance costs and maximize machine/fleet availability (Group 3).

For Group 1, this platform should be user friendly, thus guaranteeing wide compatibility and easy implementation, as well as workers' safety, reduction of waste and optimization of maintenance time. Moreover, it should have on site or on cloud installations for cyber security and better planning and after sales support.

For Group 2, the platform should be a complete asset formed by digital report, health indicators, graphical KPI visualization, performance dashboard, thus guaranteeing optimal asset management, efficient production with best possible usage of tools (lifetime), profit and data gathering management. Moreover, it should be able to predict when a machine will fail and what's the cause (performing a root-cause-analysis).

For Group 3, the platform should be provided to customers in two versions, a full and a stripped version. Generally, it should be characterised by integration from sensors to dashboard for decision support (a unique chain from sensors to dashboard). The solutions should be timely (real-time) and online. It should be compared to a "software as a service solution", i.e you pay the components of Z-BRE4K that you actually select, which are customisable and simple (technical skills are not necessary to use the platform). Furthermore, it should provide the possibility to connect the platform with the existing systems already used by companies.

Regarding the possible users of the platform, all groups agreed upon maintenance managers, production and process engineers. Group three extended the use of the platform to machine operators, financial departments and executive boards.

The platform should have a basic offering and some extra features as well. The basic offering (foreseen for the light version) should have a fixed dashboard where solutions can be used as it is (no customisation), so rule engine for decision support is static; while extra features are provided in the full version and include the possibility of tailoring the platform to the users' needs, a dynamic engine for decision support, continuous learning and virtual reality of your production line (Group 3).

For Group 2, the basic offering would provide alarm generation, prescription of actions for maintenance (prognosis), RUL prediction of machines failure and reasons behind failure. The extra featuring would include intuitive ways of utilization (e.g. touch screen), better visualization functionalities as demanded by different customers and AR maintenance instructions to perform the maintenance optimally by guiding the user in a simple and immediate way.

Regarding the Information that users can access and the procedures of access, Group 2 said that it depends on the type of user and company, thus the platform should adapt to their different needs (case by case scenarios & customisation). According to Group 3, customers should be able to see the status of machines, the different failures and downtime, graph anomalies of historical events, RUL estimation, sensor status and values, scheduled tests and there should be a combination of alarms, dashboard, UI, SMS and e-mail, depending on the type of information and user.

Customer Segments

The Customer Segments block defines the groups of (profitable) people or organisations a company reaches and serves through its products and services.

Group 4, formed by four different companies (GESTAMP, SACMI, PHILIPS and CDS), analysed this block focusing on four questions:

- What do we expect from Z-Bre4k?
- Understanding the end user and the customer:
  a. Who are they (needs, characteristics, activities)?
  b. What do they want to see?
- What is essential vs what is nice to have?

According to GESTAMP, Z-BRE4K platform should provide maintenance activities suggestions, alarms before breakdowns (email, SMS, HMI?) and the possibility to reduce mean time to repaire. For GESTAMP the main users will be maintenance and production managers whose main necessities consist of reducing mean time to repair, carrying out preventive maintenance activities, preventing potential breakdowns, knowing the remaining time till breakdown and the status of all components, receiving proposal of maintenance activities and possible strategies and eventually, being aware of the stock of elements.

For SACMI, the Z-BRE4K platform should improve machines from fields data, optimize information from fields, give the best OEE to customer and allow users to “know the machine better”. SACMI users would be maintenance and development engineers working in after sales and testing operations and looking for graphs to debug problems, simple interface to fill information, proposal for what to do when facing problems and optimization of information to manage spare parts. SACMI considered essential to have a simple interface and the ability to fill maintenance information not tracked by sensors.

PHILIPS expects the platform to communicate when the machine will break down, which parts need to be repaired and what is the status of the rest of the machines at the following breakdown. The platform would be used by operators - PHILIPS expect them to be able to play the maintenance, die maintenance operators and engineers. Operators must be able to detect the status of machines in daily management reports (every 10 hours), to have an alarm for the change in normal behaviour and the reasons for this change. For maintenance operators, the platform should allow to identify error parts that need repair, the mean time to repair and the status of other die modules. For engineers, the platform should provide raw data on which they could make their own analysis and overview.

CDS expects Z-BRE4K platform to allow users to know when the machine will break and how they could plan maintenance. The platform would be used by maintenance engineers and plant managers which needs statistics of alarms, simple interface to see where the problem is, graph of sensor related to the problem at high frequency in endless when stops occur, warning before stops, reports of machine status every week and management of this report. Moreover, maintenance managers would like to know which parts have problems and which spare parts are needed, while plant managers need the percentage probability of a problem to occur and the time for the repair. Ultimately, they require an immediate and effective way to receive this information such as email or SMS.

3.4 Innovation Management

The main objectives of innovation management activities for the Z-Bre4k project is to ensure the effective deployment of the exploitation plan, leading to a successful introduction of novel technologies/ solutions/ products to the market.

In the present document the approach and timeline of the innovation management activities is highlighted. This is in order to create in this PEDR document a high-level view on the innovation management activities performed and the ones planned up to project closing. The activities carried out in the respective task (T8.4 Innovation Management) and the conclusions stemming out of them will be thoroughly reported in a separate deliverable, D8.8 Innovation Management, due M42.

Thus far, innovation management activities were focused on understanding the innovation of each result produced in the project, defining the target market including its size and prospects, and identifying the competitive forces in the market. Building upon that, the potential customer segments are defined and evaluated, while the value proposition of Z-Bre4k for each segment is defined. A thorough SWOT analysis will show the positioning of Z-Bre4k against the competition and reveal opportunities and threats in its environment. Finally, the innovation margins, which will be the focus towards project closing, will reveal the extend of progress Z-Bre4k brings to its prospective customers, considering their current maintenance practices.

All the innovation management analysis develops around the two main elements already mentioned in 3.3.1, the offering (i.e. value proposition) and the targeted customer segments, the ones who will be realizing the benefits of predictive maintenance by using Z-Bre4k.

The following summarize the focus areas of innovation management activities since the beginning of the project:

- The market potential of predictive maintenance solutions was analysed. According to estimates from Deloitte, poor maintenance strategies can reduce a plant's overall productive capacity by 5% to 20%. Unplanned downtime costs industrial manufacturers €43 billion ($50B) per year.
- Predictive maintenance terminology is not yet standardized, we thus needed to develop new definitions for the "maintenance levels", from reactive and planned towards predictive and prescriptive.
- Using the individual exploitable results and the input provided by the consortium partners, CORE together with CRIT (DEM) defined the value proposition of the Z-Bre4k integrated suite, which was then presented and adjusted in the Exploitation workshop in Bilbao.
- Aiming to identify the market characteristics and the opportunities for Predictive Maintenance, we did a market breakdown for the total Industrial sector and defined the most relevant market segments for Z-Bre4k.
- In order to better understand the competitive environment in the predictive maintenance realm, we studied more than 30 competitive offerings, from SMEs or Large

Enterprises. These were then mapped along two axes, the type of offering they provide, and the number of industry verticals they serve. This helped us cluster PdM providers in 4 categories, making it easier to understand the competitive dynamics.

- We further performed a deep-dive analysis in the business models of three different competitive offerings. We looked at a large enterprise trying to develop the new Operating System for IIoT (Mindsphere from Siemens), an OEM trying to augment its offering with PdM services (FANUC), and a tech start-up, aiming to develop advanced AI solutions for the industry.
- The market and competition inputs were then brought together in an analysis of the industry's competitive forces, using the Porter's Five Forces methodology.
- Using the input from the technology partners and the end users we were able to check if and how well the value proposition of the project aligns with the expectations of our two main customer segments, namely manufacturing companies and OEMs. We then did a further comparison between the product functionalities the customers wish to have and the current product design. By analysing the gap between the customers' needs and what Z-Bre4k offers, we were able to develop improvement suggestions for the technology partners.
- A detailed and weighted SWOT analysis was performed, in order to better understand the positioning of Z-Bre4k in the market. Partners were asked to provide input on the Strengths and Weaknesses of their individual results, while also reporting the Opportunities and Threats that push or respectively hinder the adoption of their results. The inputs on the strengths and weaknesses provided were analysed and clustered in four key areas, (1) technical features, (2) cost competitiveness, (3) Usability, and (4) Holistic solution. Each cluster has various subcategories, and all of them were weighted depending on the importance they have for the market and the willingness of Z-Bre4k to provide a qualitative solution covering each subcategory.

The next steps in the innovation management activities will focus on the development of the innovation margins. A thorough list of the customers' starting technology status and needs will be compiled using the Z-Bre4k demo cases as proxy. This will be compared against the new state achieved with the application of Z-Bre4k technologies.

Parallel to that, the industry, market, and competitive analyses will be constantly revisited, since the predictive maintenance, i.e. the relevant market environment of Z-Bre4k, field is changing at a fast pace.

3.5 Key exploitable results

This section will be implemented at a later stage of the project and it will be updated in a subsequent release of the PEDR.

3.5.1 Exploitation and IP claims

This section will be implemented at a later stage of the project and it will be updated in a subsequent release of the PEDR.

4 PROJECT RESULTS AND MANAGEMENT OF THE INTELLECTUAL PROPERTY

Protection of Knowledge and Know-How is a fundamental asset of collaborative research and innovation projects, where several partners with different mindsets and interests come to sit at one table to work together. The proper Intellectual Property management of the previous and foreground knowledge, generated within the project allows to:

- disclose know-how and innovative ideas in a safety environment
- prove the ownership or joint ownership of a result or output of the project
- carry out business actions and make profit from commercial exploitation
- prevent or discourage any improper use of the knowledge and results from others.

The efficient and strategic safeguarding and protection of the intangible assets derived from project's activities through Intellectual Property Rights (IPR) and confidentiality rules has gained an increased importance due to the emphasis of the H2020 program on a more effective exploitation of project's outputs.

Relevant IP claims and issues arise from the outset of the project during the conceptualization phase and grant/consortium agreement preparation. However, IPR last for the whole duration of the project: during its execution and implementation, up to the exploitation and commercialization phase. Timing is therefore a fundamental aspect.

Each project period phase must correspond with a proper IP management step[2]:

- **Proposal Phase**: IP issues must be addressed in both the Grant Agreement and the Consortium Agreement and each partner should make sure that both these documents addresses their needs and that the set of rules established are suitable for the further implementation of the project.
    - Define the **existing knowledge**, the background. It is important to state whether or not background information will be used throughout the project. This is very useful to avoid possible disputes on ownership issues and access rights to background and results within the project life cycle.
    - Consider **potential confidentiality** issues to avoid that other partners disclose sensible data owned by another partner of the consortium, or that is intended for Intellectual Property rights
- **Implementation phase**: during this phase IP management should cover several aspects.
    - Knowledge management: an efficient knowledge management including the management of IP should be an integral part of the overall project management structure.
    - Confidentiality obligations: the specification of confidentiality obligations. Must be agreed with the partners on what information will be deemed confidential within the project, to whom and under what conditions confidential information

[2] Your Guide to IP in Horizon 2020, IPR Help Desk
https://www.iprhelpdesk.eu/sites/default/files/documents/EU-IPR-IP-Guide.pdf

may be transferred or disclosed, and how long confidentiality obligations will be upheld.
    - Ownership and transfer of ownership of results: to facilitate the matter of joint ownership a written agreement between the partners involved can be signed;
    - Protection and exploitation of results: it is important to regulate the IP protection of results capable of industrial or commercial application.
    - Background and Access rights: the rules for using the background of other partners must be established.
    - Settlement of disputes: define the rules in case of disputes on IP arising during the project implementation.
- **Conclusion phase**: project partners must be aware that obligations concerning IPR management and certain provisions in the agreements remain in force after the project conclusion. Confidentiality obligations, transfer of results, obligations to protect results capable of commercial exploitation must be considered also after the successful end of the project.

As previously mentioned within this document, Z-BRE4K consortium has already established a set of rules to manage Intellectual property within both the Section 3 of the Grant Agreement and the Section 9 of the Consortium Agreement at the proposal stage of the project. While the Grant agreement regulates the rights and obligation between the beneficiaries and the European Commission, the Consortium Agreement sets out the legal basis related to the implementation of the project among partners.

Z-BRE4K IP management strategy aims to recognize from the beginning any potential disputes arising from the implementation of the project. To be effective in achieving this goal the Dissemination and exploitation manager has organized a workshop focused on the further characterization of project results and on the establishment of the ownership of the knowledge and know-how that each result implies.

The methodology followed by Z-BRE4K consortium will be the following:

a. A **preliminary training session on IP and its relationship with the exploitable results** will be carried out by the Dissemination and Exploitation Manager (DEM) indicatively during M13. The webinar will deal with the consolidated methodology that the consortium will use for the exploitable results and IP assets characterization. The training will be organized into two sections. The first one will address Exploitable Results-related concepts: what they are, what type of information project partners should report for a more detailed characterization, who are the right organization profiles to be involved in their definition/assessment, etc. The second section will be oriented to IP issues: background and foreground concepts will be introduced, the rules of H2020 program on IP will be explained to create awareness among the partners on IP issues and the importance of their contribution towards the maximization of the project impact.
b. Each partner will be **individually interviewed by the Dissemination and Exploitation Manager**. Starting from the preliminary list of Exploitable Results, *ad hoc* and customized

questions will be outlined for each partner to better describe the results and to collect more specific data on the exploitation vision.

c. During the third periodic meeting (M16), the Dissemination and Exploitation manager will hold a workshop wherein the results of the work attained so far will be presented to the whole consortium, focusing on the foreground and background matrixes preliminary filled by the Dissemination and Exploitation Manager, where it is shown the knowledge that each partner contributes for each exploitable result. Partners will be asked **to further assess the matrixes indicating potential foreground (F) or background (B)in other partners' exploitable results**.
d. The same table will be subsequently filled with regards to the **exploitation claims** expressing the intention of the partners to exploit the results by:
    - making them and selling them (M)
    - using them internally to make something else for sale (U). U applies also to universities willing to use the result in new research projects.
    - to license them to 3rd parties (L);
    - to provide other services or exploitation means (i.e.: consultancy) (O).

    Further information on this matrix can be found in Chapter 4.1.
e. A final matrix will summarize the previous ones highlighting potential synergies or eventual criticalities like partners that claim the intention to exploit nearly all the exploitable results even by means of activities that are not typical of a the organization they belong to, that declare the intention of exploiting the project outcomes in any possible way apparently without any specific business model in their mind, possibility of arising disputes on the ownership.

Following this methodology Z-BRE4K consortium should achieve a more detailed characterization of the results, a clearer vision for their exploitation and a more defined IP management strategy (indicatively by M18). Topics like the business plan and market replication of Z-BRE4K exploitable results will be more deeply addressed in the deliverables of WP7, however the Plan for Exploitation and Dissemination of Results will briefly touch upon these topics in relation to the exploitable results description.

The information collected so far will be included in an updated version of the D8.3 that will be presented at the 5th General Assembly at M24.

The European Participant Portal glossary defines:

- **Background** as "Any data, know-how and/or information, whatever its form or nature (tangible or intangible) including any rights such as intellectual property rights which are needed to carry out the project or exploit its results".
- **Foreground** as "Any tangible or intangible output of the action (such as data, knowledge and information, whatever their form or nature, whether or not they can be protected), which are generated in the action, as well as any attached rights, including intellectual property rights".

4.1 IPR protection Strategy

IPR protection Strategy

A proper management of intellectual property is crucial to achieve an effective exploitation of the results. In order to assess the best exploitation strategy, the BFMULO Matrix will be implemented to determine the involvement of project partners in each of the Exploitable Results (ER).

In a BFMULO Matrix partners indicate their intentions corresponding to each of the ERs through writing letters B, F, M, U, L and O. The letters stand for:

- **B** = IPRs on background information:

Information excluding foreground information, brought to the project from existing knowledge, owned or controlled by project partners in the same or related fields of the work carried out in the research project.

- **F** = IPRs on foreground information:

Information including all kind of exploitable results generated by the project partners or 3rd parties working for them in the implementation of the research project. To have an F in an exploitable result it is necessary that a partner has a task(s) in the project related to that very result.

- **M** =Making the results:

Making the products, manufacturing and selling or directly implementing it through own facilities and skills.

- **U** = Using the result,

Using the result, implemented with own knowledge to develop new ranges of products or newer processing. Furthermore, the direct or indirect utilization of foreground in further research activities other than those covered by the project, or for developing, creating and marketing a product or process, or for creating and providing a service.

- **L** = Licensing the result:

Earning from a negotiation towards third parties outside the consortium.

- **O** = Other exploitation means:

Any other exploitation means (e.g.: consultancy, provide services, etc).

This chapter will contain the previously mentioned tables filled by each partner claiming the knowledge that each one of them contributes for each exploitable result and the use they will make of it. This information will be collected following the 5th General Assembly meeting at M24.

Table 5 Exploitation Strategy Matrix on Background/Foreground IP

RESULTS/ PARTNERS	RESULT 1	RESULT 2	RESULT 3	RESULT 4	RESULT 5	…	RESULT N
AIMEN							
ATLANTIS							
BRUNEL							
CORE							
INNOVALIA							
FRAUNHOFER							
CRIT							
SACMI							
TRIMEK							
GESTAMP							
INOVA							
HOLONIX							
EPFL							
PHILIPS							
IMEC							
CDS							
AIC							

Table 6 Exploitation Strategy matrix on Making, Using, Licensing results or any other means of exploitation

RESULTS/ PARTNERS	MAKING	USING	LICENSING	OTHER
RESULT 1				
RESULT 2				
RESULT 3				
RESULT 4				
RESULT 5				
RESULT 6				
…				
RESULT N				

Potential synergies and criticalities arising from the tables will be discussed during the workshop of the 5th Periodic Meeting. Furthermore, the Dissemination and Exploitation manager will organize individual call to mitigate potential problems or promote and support the synergies arising among partners.

4.2 Knowledge Management

A Knowledge Management system will be developed, which incorporates in a structured way, the technical and business knowledge created during the Z-Bre4k project. Knowledge management concerns the processes of creating acquiring, capturing, sharing and using knowledge to enable learning in organizations. Knowledge management allows to achieve organizational efficiency and competitive advantage, to maximize organizational potential and to manage intellectual capital.

According to the GA, a Knowledge Management document, based on DMP, will be drafted to describe how the acquired data and knowledge will be shared and/or made open, and how it will be maintained and preserved. The identifiable project data will be provided in a manner to define the relevant knowledge, increase partners' awareness, validate the result, and timeframe of actions. All partners will be responsible for periodically updating the Knowledge management system with outcomes of research work conducted by other groups and any new patents, i.e. to ensure that ongoing relevant technological developments and innovations are identified, analysed, and hopefully built upon during the course of the project.

4.2.1 Knowledge management system

Starting from Y3, a Knowledge Management Document will be drafted outlining, on the one hand, how project research could be transformed into useful and exploitable knowledge, which will be shared and maintained/preserved, and on the other, how existing knowledge could contribute to project results. For this purpose, a table will be drafted and shared among partners to collect the updated outcomes of project research and knowledge produced during the project and insights on how it can be shared and reuse. Moreover, a patent analysis may be conducted to verify if relevant technological developments similar to Z-BRE4K results are being pursued, as a Freedom To Operate (FTO) tool. Further information will be found in the D8.9 Knowledge and IPR Management (confidential).

4.2.2 Open Access of publications

All projects receiving Horizon 2020 funding are required to make sure that any peer-reviewed journal article they publish is openly accessible, free of charge (article 29.2. Grant Agreement).

Every partner should send the consortium the content and materials they wish to disseminate at least 30 days before their publishing, for the PSC approval.

Z-BRE4K and its members have agreed to participate in a green open access policy, which states that scientific publications and public deliverables must be uploaded to an online repository. Self-archiving ('green' open access) means that a published article or the final peer-reviewed manuscript is deposited in an online repository before, alongside or after its publication. Repository software usually allows authors to delay access to the article ('embargo period') If this route is chosen beneficiaries must ensure open access to the publication within a maximum of six months (twelve months for publications in the social sciences and humanities). OpenAIRE (website link) is an online archive powered by the European Commission that provides open

science services for different stakeholders in Europe and beyond. The purpose of this repository is to ensure interoperability between researchers, content providers, research administrators and funders, build global open access bridges and facilitate open innovation. In addition, OpenAIRE can also be linked to other repository platforms, such as Zenodo (website link). This repository is a safe and intuitive platform to share all research outputs (i.e.: documents, GitHub datasets, etc.) among different communities, integrating them to the European Commission funded projects via OpenAIRE. All Z-BRE4K scientific papers, datasets and public deliverables are included in OpenAIRE via Zenodo if not previously included in OpenAIRE's connected databases.

4.3 Data Management

The amount of data generated is continuously increasing while the use and re-use of data to derive new scientific findings is more or less stable. This information would be useful in the future if data is well documented according to accepted and trusted standards which enable the recognition of suitable data by negotiated agreements on standards, quality level and sharing practices. For this purpose, the Data Management Plan (DMP) defines strategies to preserve and store the data over a defined period of time in order to ensure their availability and re-usability after the end of Z-Bre4k project.

DMP will define how this data will be managed and shared by project partners, and also, how this information will be curated and preserved during and after the project duration. According to the Guidelines of Open Research Data in Horizon 2020[3], as part of making research data findable, accessible, interoperable and re-usable (FAIR), a DMP should include information on:

- The handling of research data during & after the end of the project.
- What data will be collected, processed and/or generated.
- Which methodology & standards will be applied.
- Whether data will be shared/made open access.
- How data will be curated & preserved (including after the end of the project).

With the aim of collecting this information and suggestion, as T8.5 task leader, TRIMEK prepared a questionnaire for all the Z-BRE4K consortium at early beginning of the project (M06). To ensure that the information given in M06 is continuously updated, partners have been asked to check and updated the questionnaire again in M18 and M24. An udpdate of the DMP will be released by M30, as agreed with EC's Project Officer.

In the WP development process, data related to the scientific and technical content and objectives might be generated. This data can be object of analysis and evaluation and it may contribute to the global knowledge generated.

[3] https://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-data-management/data-management_en.htm

The mentioned questionnaire that aims at identifying and gathering all the data sets to be generated by all consortium partners during the lifetime project, covers the following aspects:

1) **Scope**

- State the purpose of the data generation/collection
- Explain the relation to the objectives of the project/WP/Task

2) **Types**

- Are the data digital/hard copies or both?
- What types of data will the WP generate/collect? Specify the types and formats of data generated/collected (for example .xls files, .ppt files, emails, .doc files)
- Is the data generated or collected from other sources under certain terms and conditions?
- How is generated/collected? Specify the origin of the data and instruments/tools that will be used.
- State the expected size of the data (if known)
- Standards

3) **Ownership**

- Is another organization contributing to the data development?

4) **Reuse of existing data**

- Specify if existing data is being re-used (if any)

5) **Data use**

- How will this data be exploited and/or shared/made accessible for verification and re-use? Outline the data utility: to whom will it be useful

6) **Dissemination Level of Data**

- Confidentiality/ Sensitive data. If data cannot be made available, explain why. Who will have access?

7) **Storage and disposal**

- How will this data be stored?
- How long is it required to keep the data? Expire date. Will revisions be kept?

8) **Rules for Data naming**

- Standards or internal rules

Results to the overall objective of Z-Bre4K project to obtain a zero-breakdown manufacturing as well as results for Z-Bre4K particular objectives, such as diagnosis and predictive maintenance, have been collected. These data can be object of analysis and evaluation and may contribute to the global knowledge generated.

Some of these data are public while some other are expected to be confidential, only accessible for Z-Bre4k consortium, or sensitive data, only accessible for certain partners.

The kind of data that have been collected are:

- Feedback and data from demonstration activities within the three use cases. The types of information are:
  - KPI's and some data files on performance of machines.
  - .xls files, .ppt files and/or .doc files. for reports.
  - Rtf documents for user acceptance questionnaires/online instruments doc files and .xls files.
- Algorithms to be used for diagnosis and predictive maintenance.
- Data to be feed into the cognitive monitoring embedded system.

5 CONCLUSIONS

The document has outlined the strategy to be followed by the consortium with regards to the communication, dissemination and exploitation activities. The aim of the plan is to lay the foundation to maximize the impact of the project during its duration and beyond its lifetime.

This first draft of the deliverable has been focused on the description of the steps to reach the stated goals and it includes a preliminary description of the exploitable results. Once the workshop on the exploitation will be carried out and a more detailed description of the exploitable results will be outlined, the relative exploitation visions business model will be developed.

6 REFERENCES

- J. Scherer, Addressing Impact and Exploitation in Horizon 2020 proposals, European IPR Helpdesk (2017)
- J. Scherer et al., Making the Most of Your H2020 Project, European IPR Helpdesk (2018)
- IP Management in Horizon 2020: project proposal, European IPR Helpdesk (2014)
- Grant Agreement, Z-BRE4K (2017)

Appendix I – Results of interviews

As reported in chapter 3.3, partners have been performing a characterization of the exploitable results during the first year. This appendix shows the implementation phase of the exploitable results as well as the responses obtained through the interviews during M12-M18.

Preliminary characterization of Z-BRE4K's exploitable results

PROPOSAL PHASE		IMPLEMENTATION PHASE		
Exploitable results	ER partner	Exploitable results	ER owner	Type of ER
Z-BRE4K STRATEGIES for improved maintainability and increased operating life of production	Joint Venture			
Z-BRE4K integrated suite for improved maintainability and Risk Management	Joint Venture			
Z-BRE4K KBS with semantic modeling of assets/ products/processes and their healthy/deteriorated signatures	EPFL, HOLONIX	Z-BRE4K Ontology	EPFL	KNOWLEDGE
New i-Like functionalities	HOLONIX	Condition monitoring module enhanced with semantic representation of the system	HOLONIX	PRODUCT
Predictive Maintenance DSS, Scheduler and Recommendations Provider	ATLANTIS	Predictive Maintenance DSS, Scheduler and Recommendation Provider	ATLANTIS	PRODUCT, SERVICE
Condition Monitoring Suite (CM) for predicting machinery system failures based on trends forecasting	ATLANTIS AIMEN	TO BE FURTHER ASSESSED m24	TO BE FURTHER ASSESSED m24	TO BE FURTHER ASSESSED m24

PROPOSAL PHASE		IMPLEMENTATION PHASE		
Exploitable results	ER partner	Exploitable results	ER owner	Type of ER
and deterioration rate				
Maintenance KRIs and Risk Management system for production systems	ATLANTIS			
		FMECA	ATLANTIS	SERVICE
Machine-learning based Recommendations for the enhanced mainDSS product, based on C-45 induction algorithm	ATLANTIS	Machine Learning System and predictive and reasoning engine.	ATLANTIS	KNOWLEDGE, SERVICE
Machine-learning based analysis for deterioration trends analysis	CORE	Machine-learning based analysis for deterioration trends analysis	CORE	SERVICE
AUTOWARE open platform and use of industrial data spaces as operating system	INNOVALIA			
In-machine metrology linked with quality inspection – new M3 platform functionalities	TRIMEK	In-machine metrology linked with quality inspection – new M3 platform functionalities	TRIMEK	PRODUCT-EQUIPMENT
New machines with predictive Maintenance capacities	SACMI	New machines with predictive Maintenance capacities	SACMI	EQUIPMENT
		Market replication framework	CRIT	SERVICE
		Machine Learning System and predictive, preventive, diagnostic analytics	BRUNEL	KNOWLEDGE
		Collaborative research:	AIC-Automotive	OTHER

PROPOSAL PHASE		IMPLEMENTATION PHASE		
Exploitable results	ER partner	Exploitable results	ER owner	Type of ER
		industrial intelligent platform for the automotive sector	Intelligence Center	
		Z-BRE4K service	PHILIPS	PROCESS
		IDS Connector(s)	INOVA+	PRODUCT
		Intelligent Predictive Maintenance Platform	GESTAMP	PROCESS
		Machine learning based fault detection/ remaining useful lifetime estimation.	imec	SERVICE
		INTERNAL SERVICE CREATION: Software development of the IR-based control system for arc welding (adapting the software to new joint/Weld configurations).	AIMEN	SERVICE
		INTERNAL PRODUCT DEVELOPMENT: Development of quality control system for arc welding based on IR technology.	AIMEN	PRODUCT-EQUIPMENT
		Embedded condition monitoring compliant with IDS	AIMEN	PRODUCT
		Z-BRE4K SERVICE	C DS	PROCESS

This is the preliminary table for the characterization of the exploitable results that it has been outlined thanks to the questionnaire on the individual exploitable results that was sent to the partner at the beginning of the first year of project.

Between month 12 and 18 those results were further analysed thanks to the planned bilateral interviews with each project partner. The following tables illustrate the results of the interviews carried out by CRIT as dissemination and exploitation manager. The results that have been characterized are divided into groups, depending on the roles of the partners components within Z-BRE4K architecture:

- GROUP 1: PdM assessment: subsystem, system and shopfloor
- GROUP 2: ML for PdM assessment at component level
- GROUP 3 Platform connectors and ontology
- GROUP 4 Data acquisition and visualization
- GROUP 5: OEMs
- GROUP 6: Use cases

GROUP 1: PdM assessment: subsystem, system and shopfloor

Decision Support System ATLANTIS

ATLANTIS EXPLOITABLE RESULT	DSS
EXPLOITABLE RESULT NAME	Predictive Maintenance DSS, Scheduler and Recommendations Provider This result (No.3) is an intelligent engine for decision support towards increased maintainability and operating life of machines, preventing various breakdowns. It exploits knowledge, alarms from prediction layer while comparing defined end user prediction rules within the system. It reconfigures system parameters (rules) in order to adjust manufacturing operations exchanging data (i.e. alarm) with higher level management system. It provides recommendations and what to do (sending mail or SMS to appropriate person) that can improve maintainability and operational efficiency at shopfloor. Z-Bre4k strategies will be tested and evaluated to the coordination through the DSS (No.3) for dynamic maintenance

	planning and operations (strategies and DSS will be integrated with MES interfaces) for decision support at manufacturing and enterprise level.
WHICH PROBLEMS ARE SOLVED	The commercial products address maintainability either through IIoT or through Enterprise Asset Management (EAM) solutions.
WHAT IS THE NEW ELEMENT OF THE RESULT THAT DISTINGUISHES IT FORM THE STATE OF THE ART?	State of the Art will be advanced through the integrated approach leveraging IIoT and predictive analytics together with EAM functionality, maintenance specific DSS and effective Maintenance Scheduling while elaborating the KRIs and Risk Assessment approaches. In addition, the DSS incorporates a Machine Learning approach for the automated and semi-automated definition of the rules and the reconfiguration of the thresholds of the defined rules, based on user feedback, for the optimization of its efficiency.
HOW BETTER IS YOUR SOLUTION (FASTER, CHEAPER, MORE RELIABLE, MORE EFFICIENT, WITH LESS UNDESIRED EFFECTS)?	More efficient, the solution is fully automated that has simulation and prediction engine to alarm services in production and logistics, provides recommendation for improvements with standard based auditing and uses data signs for more accurate and effective recommendation.
WHO WILL USE THE RESULT?	Consumer who purchase it: Companies with monitoring systems, Control software enterprises for production optimization, Companies selling DSS systems, Simulation Software, Maintenance and Inspection companies, etc.
WHY SHOULD THE END USERS INVEST IN OR ADOPT YOUR RESULT?	Because it is a new framework applicable both to new and existing manufacturing lines that will address the current change of

	manufacturing needs and lead industries to its optimal performance, increased quality, minimized costs, and workers safety mitigating the number of accidents. *What the HMI of your software will look like?* The DSS HMI is a user-friendly UI focused for both the technical operators (who are on the shop floor) and the technical managers. The status view depicts all the values and states changes in time, while the Fine State Machine view provides a wide range of parameters that satisfy almost any monitoring need). *Are you planning to sell your results as a toolkit for predictive maintenance? Will them be sold as separate services?* DSS can be sold with ATLANTIS prediction software but also as a standalone product that works with other prediction software (with the use of an adapter software).
WHAT ARE THE STAKEHOLDERS TO BE INVOLVED IN ORDER TO ACHIEVE YOUR EXPLOITATION VISION?	Most of them are professionals in the Industrial Manufacturing, Enterprise Asset Management (IM/EAM), Maintenance consultants, CMMS/EAM integrators, Product data management (PDM) Machine Learning experts and within IIoT domain. ATLANTIS, through their engagement in the Hellenic Maintenance Society (HMS), European Federation of National Maintenance Societies (EFNMS), Association of Information Technology Companies of Northern Greece (SEPVE) and Greek Exporter Associations (SEVE) has access to major industrial manufacturing players and stakeholders in Greece, in Balkans and in whole Europe. Through these channels the company monitors very closely the state of-

	the-art developments in the market with its medium-term strategy is oriented towards the Factories of the Future and Industry 4.0 Industrial Manufacturing and Enterprise Asset Management, IIoT professionals: European Federation of National Maintenance Societies, National Maintenance Societies, Hellenic Maintenance Society, etc.
DO YOU EXPECT TO HAVE REACHED A TRL HIGHER OR LOWER THAN 7 AT M42?	TRL 7-9
WHAT ARE THE EXPECTED STEPS IN YOUR GO TO MARKET STRATEGY?	Z-Bre4k models will be enriched to detect deterioration rate and raise alarms for further actions at MES level. It is expected for TRL to reach 7 for the enhanced module. Main DSS is a complete system qualified in the operational environment of about 60 pilot installations in different EU countries. It is currently at TRL 8, providing decision support, EN15341 standard KPI-based auditing and automatic recommendations for improving maintainability and maintenance performance. The go to market strategy will be to create a small-scale pilot projects with potential early solution adopters whom we offer specific price (during and after the projects life). The products will be sold by various methodology: Sales through Collective organization, Direct sales to ordinary customers and Associated Companies. The following activities will be carried out: - Product operation, marketing and sales, customer support, promotion and internationalization costs, initial product commercialization and H/W cost, legal/IPR issues costs, software updates, coast for awareness. The channels to be used will be: collective organizations, maintenance

	consultants, CMMS/EAM integrators, direct sales to key customers, marketing campaigns, Asset Management Days and Fairs.
WHO IS THE COMPETITOR?	IBM: is the multinational technology company with the headquarters in Armonk, New York, USA. This cloud computing, cognitive computing industry, operate in over 170 countries, employing 380,300 people with US$ 79.139 billion in revenue. 2)Intel: is a multinational corporation and technology company with its headquarters in Santa Clara, California. This semiconductor industry employs 106,000 people and its revenue in 2017 was US$62.76 billion. 3) GE Measurement & Control: is an affiliate business of General Electric that is specialized in the design and manufacture of sensing elements, devices, instruments, and systems that enable customers to monitor, protect, control, and validate the safety of their critical processes and applications. It employs 11000 people. 4) Siemens PLM: is a computer software company specializing in 3D & 2D Product Lifecycle Management (PLM) software. It is headquartered in Plano, Texas. 5) GE Digital is a subsidiary of the American multinational conglomerate corporation General Electric and it is headquartered in San Ramon, California, United States. The company provides software and advisory services around operational technology and infrastructure.
NAME COMPETITIVE SOLUTIONS THAT ARE PARTIALLY OVERLAPPING WITH YOUR RESULT.	For DSS: 1) IBM – Advanced Analytics is a brand name with optimization and customization capabilities with other IBM products. 2) Intel - Intel® Decision Support is high quality brand name, with cloud-based

	application where sensor data are automatically collected and transmitted to Intel. 3) GE - Decision Support Studio compatible with other GE products, suite of products that optimizes business operations. 4) Siemens PLM: product lifecycle management and manufacturing operations management software. 5) Predix, Digital twin: consists of sophisticated models or system of models based on deep domain knowledge of specific industrial assets.
WHO IS SELLING THESE PRODUCTS?	Support and Maintenance services, Monitoring simulation modules sales, Re-Sellers.
WHO ARE THE PARTNERS INVOLVED IN YOUR RESULT?	ATLANTIS is also working on ML/ prediction algorithms (result No.1 above), so no other owners. The result will be protected through licenses and trade secret.
HAVE YOU PROTECTED OR WILL YOU PROTECT THIS RESULT? HOW? WHEN?	Through business agreement and negotiations with every client we create a contract.

FMECA _ ATLANTIS

ATLANTIS EXPLOITABLE RESULT	FMECA
EXPLOITABLE RESULT NAME	FMECA and Maintenance KRIs and Risk Management system for production systems Provider FMECA is a software application, that presents failure modes, respective causes and immediate/final effects providing an automated FME(C)A process with the goal to replace the manual FMECA process.

	Z-Bre4k (apart from its prediction capabilities) will also provide a better understanding of the failures through its FMECA subsystem. The FMECA provides the Key Risk Indicators (KRI) based on the trends, standards and patterns. Each risk will be categorized by a Risk Prioritization Number (RPN) having metrics for both the probability and the severity of each risk, allowing mitigation and contingency actions to lower the probability and the severity, respectively.
WHICH PROBLEMS ARE SOLVED	The commercial products address maintainability either through IIoT or through Enterprise Asset Management (EAM) solutions.
WHAT IS THE NEW ELEMENT OF THE RESULT THAT DISTINGUISHES IT FORM THE STATE OF THE ART?	State of the Art will be advanced through the integrated approach leveraging IIoT and predictive analytics together with EAM functionality, maintenance specific DSS and effective Maintenance Scheduling while elaborating the KRIs and Risk Assessment approaches. Due the evolution of Industry 4.0 and demand of the industry to evaluate risks of machinery, Z-Bre4k will be a pioneer in this area, advancing the SoA by elaborating KRIs and Risk Assessment approaches in the maintenance field of industrial manufacturing.
HOW BETTER IS YOUR SOLUTION (FASTER, CHEAPER, MORE RELIABLE, MORE EFFICIENT, WITH LESS UNDESIRED EFFECTS)?	More efficient. FMECA will be developed according to IEC60812 international standard that will specify metrics and thresholds to measure each KRI correlated with multiple other KRIs being associated to a single or multiple risk,

	furtherer defining and calculating RPN while supporting RCA. It will be an easy to use tool, with associated recommendations for supporting asset risk management in asset-intensive industries (RPN, FMEA, FMECA, KRIs, CCF, Criticality Matrix, etc.).
WHO WILL USE THE RESULT?	Consumer who purchase it: Companies with monitoring systems, Control software enterprises for production optimization, Companies selling DSS systems, Simulation Software, Maintenance and Inspection companies, asset risk management in asset-intensive industries etc.
WHY SHOULD THE END USERS INVEST IN OR ADOPT YOUR RESULT?	Because it is a new framework applicable both to new and existing manufacturing lines that will address the current change of manufacturing needs and lead industries to its optimal performance, increased quality, minimized costs, and workers safety mitigating the number of accidents. *What the HMI of your software will look like?* The FMECA HMI is a web based, simple, user-friendly, UI focused on engineers (technical managers) that can use the s/w to identify and define critical items/failure modes. Furthermore, extra reporting functionalities could be added, for caring out the measures to address the most serious concerns. *Are you planning to sell your results as a tool-kit for predictive maintenance? Will them be sold as separate services?* FMECA can be sold with ATLANTIS DSS and prediction software, but also as a standalone product that works with other DSS and

	prediction software (with the use of an adapter software).
WHAT ARE THE STAKEHOLDERS TO BE INVOLVED IN ORDER TO ACHIEVE YOUR EXPLOITATION VISION?	Most of them are professionals in the Industrial Manufacturing, Enterprise Asset Management (IM/EAM), Maintenance consultants, CMMS/EAM integrators, Product data management (PDM) Machine Learning experts and within IIoT domain. ATLANTIS, through their engagement in the Hellenic Maintenance Society (HMS), European Federation of National Maintenance Societies (EFNMS), Association of Information Technology Companies of Northern Greece (SEPVE) and Greek Exporter Associations (SEVE) has access to major industrial manufacturing players and stakeholders in Greece, in Balkans and in whole Europe. Through these channels the company monitors very closely the state of-the-art developments in the market with its medium-term strategy is oriented towards the Factories of the Future and Industry 4.0 Industrial Manufacturing and Enterprise Asset Management, IIoT professionals: European Federation of National Maintenance Societies, National Maintenance Societies, Hellenic Maintenance Society, etc.
DO YOU EXPECT TO HAVE REACHED A TRL HIGHER OR LOWER THAN 7 AT M42?	TRL 7-9
WHAT ARE THE EXPECTED STEPS IN YOUR GO TO MARKET STRATEGY?	We approach and crate a small-scale pilot projects with potential early solution adopters whom we offer specific price (during and after the projects life) *Who will be your partners in selling this product to the customers?*

	Sales through Collective organization, Direct sales to ordinary customers and Associated Companies *Which activities will your partners carry out and what will you carry out? What resources will you need?* Product operation, marketing and sales, customer support, promotion and internationalization costs, initial product commercialization and H/W cost, legal/IPR issues costs, software updates, coast for awareness. *How are you planning to reach your customers, which channel will you use?* Through collective organizations, maintenance consultants, CMMS/EAM integrators, direct sales to key customers, marketing campaigns, Asset Management Days and Fairs
WHO IS THE COMPETITOR?	IBM: is the multinational technology company with the headquarters in Armonk, New York, USA. This cloud computing, cognitive computing industry, operate in over 170 countries, employing 380,300 people with US$ 79.139 billion in revenue. 2)Intel: is a multinational corporation and technology company with its headquarters in Santa Clara, California. This semiconductor industry employs 106,000 people and its revenue in 2017 was US$62.76 billion. 3) GE Measurement & Control: is an affiliate business of General Electric that is specialized in the design and manufacture of sensing elements, devices, instruments, and systems that enable customers to monitor, protect, control, and validate the safety of their critical processes

	and applications. It employs 11000 people. 4) Siemens PLM: is a computer software company specializing in 3D & 2D Product Lifecycle Management (PLM) software. It is headquartered in Plano, Texas. 5) GE Digital is a subsidiary of the American multinational conglomerate corporation General Electric and it is headquartered in San Ramon, California, United States. The company provides software and advisory services around operational technology and infrastructure.
NAME COMPETITIVE SOLUTIONS THAT ARE PARTIALLY OVERLAPPING WITH YOUR RESULT.	1) FMECA Software Module of Reliability Workbench provides the full framework and reporting facilities to allow users to construct FMECA according to various standards (MIL-STD-1629A, BS 5760 Part 5, GJB 1391-92, AIAG FMEA 3, SAE J1739, ARP5580). 2) FMECA (IEC 61508) Module of ITEM Toolkit of itemSoftware supports the following: MIL-STD-1629a, IEC 61508, ISO 9000/QS 9000, ISO 26262 and BS 5760 Part 5, provides total flexibility for applying FMECA to the Failure Mode Effect Analysis and Criticality Analysis incorporating a fully integrated IEC 61508 FMEDA analysis. 3) RAM Commander is a comprehensive software tool for Reliability and Maintainability Analysis and Prediction, Spares Optimization, FMEA/FMECA, Testability, Fault Tree Analysis, Event Tree Analysis and Safety Assessment. Its reliability and safety modules cover all widely known reliability standards and failure analysis approaches.

WHO IS SELLING THESE PRODUCTS?	Support and Maintenance services, Monitoring simulation modules sales, Re-Sellers.
WHO ARE THE PARTNERS INVOLVED IN YOUR RESULT?	ATLANTIS only
HAVE YOU PROTECTED OR WILL YOU PROTECT THIS RESULT? HOW? WHEN?	A licensor may grant a license under intellectual property laws to authorize a use to a licensee, sparing the licensee from a claim of infringement brought by the licensor. The result will be protected through licenses and trade secret. Through business agreement and negotiations with every client we create a contract.

Predictive Maintenance Module _ ATLANTIS

ATLANTIS EXPLOITABLE RESULT	**Predictive Maintenance Module**
EXPLOITABLE RESULT NAME	Predictive Maintenance Module The result is based on supervised Machine Learning approaches for the prediction of prominent failures based on current and historical information obtained by the existing monitoring and control systems of the pilots. Predictive Maintenance module is within the prediction layers in relation to Z-PREDICT/DIAGNOSE/ESTIMATE strategies, where the outcome for decision making is the definition of system inputs, outputs and control parameters.
WHICH PROBLEMS ARE SOLVED	The commercial products address maintainability either through IIoT or through

	Enterprise Asset Management (EAM) solutions. • Equipment downtime is decreased and the number of major repairs is reduced • Better conservation of assets and increased life expectancy of assets, thereby eliminating premature replacement of machinery and equipment • Reduced overtime costs and more economical use of maintenance workers due to working on a scheduled basis instead of a crash basis to repair breakdowns • Timely, routine repairs circumvent fewer large-scale repairs
WHAT IS THE NEW ELEMENT OF THE RESULT THAT DISTINGUISHES IT FORM THE STATE OF THE ART?	State of the Art will be advanced through the integrated approach leveraging IIoT and predictive analytics together with EAM functionality, maintenance specific DSS and effective Maintenance Scheduling while elaborating the KRIs and Risk Assessment approaches. The distinction point of the proposed prediction technique towards maintenance issues, is in its core, where event-based prediction is used utilizing state-of-the-art motif detection techniques with graph theory algorithms for the events generation from sensorial data, in combination with state-of-the-art predictive maintenance solutions based on supervised machine learning techniques and advanced pre-processing procedures.
HOW BETTER IS YOUR SOLUTION (FASTER, CHEAPER, MORE RELIABLE, MORE EFFICIENT, WITH LESS UNDESIRED EFFECTS)?	More efficient. The proposed predictive maintenance solution is easier to be applied in a wider range of applications as it is capable to utilize any source of information (i.e. both sensorial and event logs). The ease of deployment has

	direct economic impact as it alleviates the need for obtaining new monitoring equipment or changing the maintenance logging policy of the company. The speed, the efficiency and the reliability of the approach are guaranteed as the core of the technique is based on combinations of state-of-the-art techniques.
WHO WILL USE THE RESULT?	Consumer who purchase it: Companies with monitoring systems, Control software enterprises for production optimization, Companies selling DSS systems, Simulation Software, Maintenance and Inspection companies, etc.
WHY SHOULD THE END USERS INVEST IN OR ADOPT YOUR RESULT?	Because it is a new framework applicable both to new and existing manufacturing lines that will address the current change of manufacturing needs and lead industries to its optimal performance, increased quality, minimized costs, and workers safety mitigating the number of accidents. *What the HMI of your software will look like?* The Predictive Maintenance module currently offers a command prompt interface where the user can provide either a very basic parametrization or tweak around with more advanced configurations based on her technical background. The command interface also allows the integration of the module with other systems as the DSS. *Are you planning to sell your results as a tool-kit for predictive maintenance? Will them be sold as separate services? How will this exploitable result be sold?* This result can be sold with ATLANTIS' DSS but also as a standalone product. The Predictive Maintenance module has implemented the

	needed bridges to communicate with various data source such as timeseries databases and it can be registered to any REST API to report its results.
WHAT ARE THE STAKEHOLDERS TO BE INVOLVED IN ORDER TO ACHIEVE YOUR EXPLOITATION VISION?	Industrial Manufacturing and Enterprise Asset Management, IIoT professionals: European Federation of National Maintenance Societies, National Maintenance Societies, Hellenic Maintenance Society, etc. Most of them are professionals in the Industrial Manufacturing, Enterprise Asset Management (IM/EAM), Maintenance consultants, CMMS/EAM integrators, Product data management (PDM) Machine Learning experts and within IIoT domain. ATLANTIS, through their engagement in the Hellenic Maintenance Society (HMS), European Federation of National Maintenance Societies (EFNMS), Association of Information Technology Companies of Northern Greece (SEPVE) and Greek Exporter Associations (SEVE) has access to major industrial manufacturing players and stakeholders in Greece, in Balkans and in whole Europe. Through these channels the company monitors very closely the state of-the-art developments in the market with its medium-term strategy is oriented towards the Factories of the Future and Industry 4.0
DO YOU EXPECT TO HAVE REACHED A TRL HIGHER OR LOWER THAN 7 AT M42?	TRL 7-9
WHAT ARE THE EXPECTED STEPS IN YOUR GO TO MARKET STRATEGY?	In Z-Bre4k the technology will be tailored to predictive maintenance, using machine-learning algorithms for improved recommendations and enhanced with an intelligent Scheduler, reaching TRL 7 at end of the project.

WHO IS THE COMPETITOR?	IBM: is the multinational technology company with the headquarters in Armonk, New York, USA. This cloud computing, cognitive computing industry, operate in over 170 countries, employing 380,300 people with with US$ 79.139 billion in revenue. 2)Intel: is a multinational corporation and technology company with its headquarters in Santa Clara, California. This semiconductor industry employs 106,000 people and its revenue in 2017 was US$62.76 billion. 3) GE Measurement & Control: is an affiliate business of General Electric that is specialized in the design and manufacture of sensing elements, devices, instruments, and systems that enable customers to monitor, protect, control, and validate the safety of their critical processes and applications. It employs 11000 people. 4) Siemens PLM: is a computer software company specializing in 3D & 2D Product Lifecycle Management (PLM) software. It is headquartered in Plano, Texas. 5) GE Digital is a subsidiary of the American multinational conglomerate corporation General Electric and it is headquartered in San Ramon, California, United States. The company provides software and advisory services around operational technology and infrastructure.
NAME COMPETITIVE SOLUTIONS THAT ARE PARTIALLY OVERLAPPING WITH YOUR RESULT.	Organizations dealing with Artificial Intelligence and Machine (Deep) Learning that are focusing on predictive maintenance. E.g.: 1) Presenso, Cloud-based software solution replaces the rule-based legacy systems, provides unparalleled operational intelligence and deep semantic insights. 2) Simularity (USA), artificial intelligence software to detect anomalies and predict events in real time. 3) DataRPM by ProgressNEXT, Anomaly

	Detection and Prediction using the sensor data from machines., etc...
WHO IS SELLING THESE PRODUCTS?	Support and Maintenance services, Monitoring simulation modules sales, Re-Sellers.
WHO ARE THE PARTNERS INVOLVED IN YOUR RESULT?	ATLANTIS As the project adopts the IDS ecosystem, the Predictive Maintenance module will communicate with the other components using IDS connectors endpoints. However, it is also capable of communicating with any other RESTful API.
HAVE YOU PROTECTED OR WILL YOU PROTECT THIS RESULT? HOW? WHEN?	A licensor may grant a license under intellectual property laws to authorize a use (such as copying software or using a (patented) invention) to a licensee, sparing the licensee from a claim of infringement brought by the licensor. The result will be protected through licenses and trade secret. Through business agreement and negotiations with every client we create a contract

GROUP 2: ML for PdM assessment at component level

Machine Learning based anomaly and fault detection and prediction of RUL _ IMEC

IMEC EXPLOITABLE RESULT	ML based anomaly & fault detection and prediction of RUL
EXPLOITABLE RESULT NAME	ML based anomaly & fault detection and prediction of RUL

WHICH PROBLEMS ARE SOLVED	ML based anomaly & fault detection and prediction of RUL Machine incipient fault detection and data-driven remaining useful lifetime estimation. • Anomaly detection: identify events that did not happen before or are not labeled by experts, which can be nothing or true anomalies that show there is a problem that should be investigated. • Fault detection: use ML to detect and locate the fault using labeled data of the sensor and classification techniques for future detection. • RUL
WHAT IS THE NEW ELEMENT OF THE RESULT THAT DISTINGUISHES IT FORM THE STATE OF THE ART?	Machine learning approaches (data-driven) will be used to detect faults in machines (new use case) and will be used for remaining useful lifetime estimation. Novelty → translating state of the art technique towards new use cases and domains + add new features (metrics profile, noise detection…)
HOW BETTER IS YOUR SOLUTION (FASTER, CHEAPER, MORE RELIABLE, MORE EFFICIENT, WITH LESS UNDESIRED EFFECTS)?	To be determined. As the ML and AI grows, it can get cheaper. Not cheaper than state of the art but at least as cheap. Faster: real time metrics profile would make it faster. More reliable: making improvements to make it better and more efficient.

WHO WILL USE THE RESULT?	R&D departments within companies will possibly be able to benefit from the results. Machine Learning companies. Researcher departments at companies, IMEC will also use to other projects with other companies. It is possible that sensor making companies might want to join solutions and integrate the anomaly detection or ML. IMEC could be able to find any type of hardware / software material to use this technology since it is a big company. At least one spin off of ML consultancy. Spin off can be created, or an existing spin off can be improved.
WHY SHOULD THE END USERS INVEST IN OR ADOPT YOUR RESULT?	If faults can be detected prematurely or the remaining useful lifetime of machines/components can be predicted, predictive maintenance can be enabled. It is important to detect anomalies, faults as soon as possible to build an accurate RUL in order to plan maintenance. It'd depend on use case. Philips case: weekly maintenance requires shutting the plant down for 8h, a lot of time is wasted.
WHAT ARE THE STAKEHOLDERS TO BE INVOLVED IN ORDER TO ACHIEVE YOUR EXPLOITATION VISION?	Industrial partners. IRF Industrial Research Fund Consortium: different researchers from universities with the aim of revalorize their research towards industry (creating spin-offs, products, etc.). Other research project in collaboration with Flemish Area for smart maintenance.

DO YOU EXPECT TO HAVE REACHED A TRL HIGHER OR LOWER THAN 7 AT M42?	Lower Explanation: research is mostly proof of concept. Demonstration could be possible, but a complete product is a huge step. Implementing in machines requires a big responsibility. Getting to TRL7 it would need long time testing, field trial.
WHAT ARE THE EXPECTED STEPS IN YOUR GO TO MARKET STRATEGY?	Purely internal use, training people in the industry so they can apply themselves for their purposes (universities, PhD) or make it better. Use and apply in new project.
WHO IS THE COMPETITOR?	Spin off other ML companies are competitors; universities try not to compete anymore (but it can be happening). Main risk is that this companies that work with AI, like Google, develop it.
NAME COMPETITIVE SOLUTIONS THAT ARE PARTIALLY OVERLAPPING WITH YOUR RESULT.	Some companies (many of the big ones like Yahoo, Google, AWS) are working on predictive maintenance.
WHO IS SELLING THESE PRODUCTS?	Not known yet
WHO ARE THE PARTNERS INVOLVED IN YOUR RESULT?	IMEC, Ghent University
HAVE YOU PROTECTED OR WILL YOU PROTECT THIS RESULT? HOW? WHEN?	We have not protected results from the Z-BRE4k project so far as no results have been achieved. We tend to have open source licenses for research purposes but not for commercial (you need to acquire the license). For ML I think is quite hard to patent, maybe for a more specific solution.

BRUNEL EXPLOITABLE RESULT	Machine Learning System and event based predictive, preventive, diagnostic analytics.
EXPLOITABLE RESULT NAME	Machine Learning System and event based predictive, preventive, diagnostic analytics.
WHICH PROBLEMS ARE SOLVED	Agreement on data acquisition from use cases and preparation of ontology for SACMI & Philips FMECA. Transition from traditional predictive maintenance, that was based on historical data and mathematical models, uncertainty, into a ML solution that does not work as individual machine, but as networked machines. Create a digital clone, virtual clone.
WHAT IS THE NEW ELEMENT OF THE RESULT THAT DISTINGUISHES IT FORM THE STATE OF THE ART?	The ontology includes soft knowledge such quality control, CAE, MTBF information, technician/expert interviews etc. are included apart from sensor data. Big data analytics to explore and identify where the sources of the information could be relevant to machine reposition and breakdown. A set of protocols and rules in which the data should be collected, correlated, synchronized and fed into the “brain” or collider. The new element is how you organize and discipline this information.
HOW BETTER IS YOUR SOLUTION (FASTER, CHEAPER, MORE RELIABLE, MORE EFFICIENT, WITH LESS UNDESIRED EFFECTS)?	The ontology of use cases w.r.t Philips and SACMI are designed for reliability, efficiency and to have less undesired effects.

	Computationally could one of the fastest, if not the fastest. Low latency integration solution too. Much more smart data use and distribution.
WHO WILL USE THE RESULT?	Industrial partners who industrialize it. SACMI, Philips, GESTAMP will be the first. If they agree to install it into their real system, we can create a commercial working product. It can become a license that can be use in any other similar manufacturer platforms, for manufacturing. Right now the best users to try it with is the ones we already have. If we can build the model for them, we could offer it to other users too (SACMI represents machine manufacturing, PHILIPS heavy duty consumer problems). We assume that some of the solution provider will want to have, at least for a period of time, exclusivity right to promote their product. I would prefer a much looser option and offer a modular solution as individual components. Need the solution to prove that results are actually good to prove its value.
WHY SHOULD THE END USERS INVEST IN OR ADOPT YOUR RESULT?	The ontology designed by Brunel provides solution to zero-unexpected breakdown of industrial components and hence the entire shop floor. The inclusion of soft knowledge provides a unique advantage of solution becoming zero-breakdown solution. The inclusion of Soft-knowledge information gathering represents the most genuine approach so far, since manufacturing systems with high levels of complexity, yet very high levels of reliability, i.e.: SACMI's CCM, show just a few breakdowns in a very long-time lapse. Including feedback from

	maintenance operations, shall help on assessing Breakdowns by a correct combination of maintenance operation, FMECA knowledge and sensing and automation data.
WHAT ARE THE STAKEHOLDERS TO BE INVOLVED IN ORDER TO ACHIEVE YOUR EXPLOITATION VISION?	All Z-Bre4k use case partners. (SACMI, Philips and GESTAMP). If we come up with a solution it can extend to other areas. Normally academics write articles referring to the project, but we can show ourselves maybe I more professional magazines (quality control), not specially academics but more practical. Exploitation vehicles: partners who will take it to market through attending fairs, writing articles, professional magazines, trade-fairs.
DO YOU EXPECT TO HAVE REACHED A TRL HIGHER OR LOWER THAN 7 AT M42?	Pilot production and demonstration TRL6. I wouldn't claim we will be at TRL7 or beyond at the end of the project, too ambitious.
WHAT ARE THE EXPECTED STEPS IN YOUR GO TO MARKET STRATEGY?	Validation & Verification process of 2-3 years until it gets to market, open it to other sectors. But depends on agreement.
WHO IS THE COMPETITOR?	Industries who use technicians/experts to analyze the condition of the machines. We want to automatize this process by including the soft knowledge provided by technicians into algorithms.
NAME COMPETITIVE SOLUTIONS THAT ARE PARTIALLY OVERLAPPING WITH YOUR RESULT.	The state-of-the-art SCADA systems are already programmed to a threshold values to raise alarms over an even. Other Universities and Academics are more collaboration than competition. It is not on a

	stage to make a competitive analysis, when we develop it more we will see the functionalities, and feature's benefits, and then compare it. It just claims right now.
WHO IS SELLING THESE PRODUCTS?	Commercially available SCADA software. Additionally: - CAE simulation companies are increasingly offering Digital Twin solutions for data-driven PdM, i.e.: ANSYS, ESI. - Service companies such as Seebo offer PdM services based on data analysis. - Big machinery manufacturers have launched dedicated divisions on digital services, i.e.: General Electric --> GE Digital, provides PdM through its IoT platform Predix. - Automation and PLM comanies are launching/purchasing Industrial IoT platforms, which may be used for PdM applications; i.e.: Siemens <-> Mindsphere, PTC <-> Thingworx.
WHO ARE THE PARTNERS INVOLVED IN YOUR RESULT?	SACMI, Philips, GESTAMP, IMEC, EPFL and CRIT. TRIMEK, AIMEN, CORE.
HAVE YOU PROTECTED OR WILL YOU PROTECT THIS RESULT? HOW? WHEN?	Tend to be harder to protect software. Often is more copyright IP protection, license.

Machine learning based analysis for deterioration trends _ CORE

CORE EXPLOITABLE RESULT	Machine-learning based analysis for deterioration trends analysis
EXPLOITABLE RESULT NAME	Machine-learning based analysis for deterioration trends analysis
WHICH PROBLEMS ARE SOLVED	Detection and prediction of deterioration trends
WHAT IS THE NEW ELEMENT OF THE RESULT THAT DISTINGUISHES IT FORM THE STATE OF THE ART?	The machine learning employment to "train" the system
HOW BETTER IS YOUR SOLUTION (FASTER, CHEAPER, MORE RELIABLE, MORE EFFICIENT, WITH LESS UNDESIRED EFFECTS)?	Currently we achieve >95% confidence level. We need to test it to our end-users
WHO WILL USE THE RESULT?	OEM Designers and Users
WHY SHOULD THE END USERS INVEST IN OR ADOPT YOUR RESULT?	It will increase their effectiveness and efficiency
WHAT ARE THE STAKEHOLDERS TO BE INVOLVED IN ORDER TO ACHIEVE YOUR EXPLOITATION VISION?	Pilot production and demonstration TRL6
DO YOU EXPECT TO HAVE REACHED A TRL HIGHER OR LOWER THAN 7 AT M42?	TRL7. We want to demonstrate System prototype in an operational environment.
WHAT ARE THE EXPECTED STEPS IN YOUR GO TO MARKET STRATEGY?	Industries who use technicians/Experts to analyse the condition of the machines. We want to automatise this process by including

	the soft knowledge provided by technicians into algorithms
WHO IS THE COMPETITOR?	The state-of-the-art SCADA systems are already programmed to a threshold values to raise alarms over an event.
NAME COMPETITIVE SOLUTIONS THAT ARE PARTIALLY OVERLAPPING WITH YOUR RESULT.	Commercially available SCADA software.
WHO IS SELLING THESE PRODUCTS?	SACMI, Philips, GESTAMP, IMEC, EPFL and CRIT
WHO ARE THE PARTNERS INVOLVED IN YOUR RESULT?	The ontology solution is protected by non-disclosure between each use case partner and Brunel. Once the data has been collected an agreement will be made.
HAVE YOU PROTECTED OR WILL YOU PROTECT THIS RESULT? HOW? WHEN?	Pilot production and demonstration TRL6

Quality control IR vision _ AIMEN

AIMEN EXPLOITABLE RESULT	**Quality control IR vision**
EXPLOITABLE RESULT NAME	PRODUCT/SERVICE: Development of quality control system for arc welding based on IR technology/Software development of the IR-based control system for arc welding (adapting the software to new joint/Weld configurations). All the info needed below has been included in the description of the PRODUCT described in other questionnaire already filled in.
WHICH PROBLEMS ARE SOLVED	No post-weld quality control check is required. The system will provide a quality diagnostic of the weld just after finishing it.

WHAT IS THE NEW ELEMENT OF THE RESULT THAT DISTINGUISHES IT FORM THE STATE OF THE ART?	The MWIR technology in which the quality control software is based on. Data processing based on convolutional neural networks (CNN).
HOW BETTER IS YOUR SOLUTION (FASTER, CHEAPER, MORE RELIABLE, MORE EFFICIENT, WITH LESS UNDESIRED EFFECTS)?	This point is going to be further investigated thanks to the market analysis on the potential market for Z-BRE4K solution.
WHO WILL USE THE RESULT?	Customers that use arc welding in their manufacturing processes. In particular, automotive companies.
WHY SHOULD THE END USERS INVEST IN OR ADOPT YOUR RESULT?	The end users can have a real time quality diagnostic of arc welds.
WHAT ARE THE STAKEHOLDERS TO BE INVOLVED IN ORDER TO ACHIEVE YOUR EXPLOITATION VISION?	IR camera supplier
DO YOU EXPECT TO HAVE REACHED A TRL HIGHER OR LOWER THAN 7 AT M42?	The expected TRL to be reached is 6 or 7.
WHAT ARE THE EXPECTED STEPS IN YOUR GO TO MARKET STRATEGY?	To transform the prototype in an industrial and robust system; to qualify the industrial system through operational tests and evaluation reports;
WHO IS THE COMPETITOR?	Most of quality control systems for arc welding are based on: 1) NDT inspection. This is the most traditional quality control and there are a lot of companies providing these systems; 2) closed-loop quality control of welding systems. The type of controls are implemented in the welding system; 3) online quality control systems: Artificial vision, etc.

NAME COMPETITIVE SOLUTIONS THAT ARE PARTIALLY OVERLAPPING WITH YOUR RESULT.	There are no commercial solutions based on IR Technology.
WHO IS SELLING THESE PRODUCTS?	Not available now, further investigations will be done in this sense.
WHO ARE THE PARTNERS INVOLVED IN YOUR RESULT?	IR cameras supplier. It is not a partner of Z-BRE4K.
HAVE YOU PROTECTED OR WILL YOU PROTECT THIS RESULT? HOW? WHEN?	AIMEN has a commercial agreement with the IR sensors supplier, which has already patented the sensor. AIMEN uses the patented sensor and develops the quality control software for every weld configuration.

Digital Twin and Predictive Maintenance _ Fraunhofer IAO

FRAUNHOFER EXPLOITABLE RESULT	**Digital Twin and Predictive Maintenance**
EXPLOITABLE RESULT NAME	Conceptual Predictive Maintenance Strategy by incooperating a digital twin.
WHICH PROBLEMS ARE SOLVED	Filling of gaps of algorithm based predictive maintenance by generating additional data and insights with a digital twin simulation.
WHAT IS THE NEW ELEMENT OF THE RESULT THAT DISTINGUISHES IT FORM THE STATE OF THE ART?	Combination of pattern recognition and simulation/digital twin.
HOW BETTER IS YOUR SOLUTION (FASTER, CHEAPER, MORE RELIABLE, MORE EFFICIENT, WITH LESS UNDESIRED EFFECTS)?	it's a holistic approach and therefore more reliable.

WHO WILL USE THE RESULT?	Researchers to further research and transfer to the industry.
WHY SHOULD THE END USERS INVEST IN OR ADOPT YOUR RESULT?	More reliable approach for predictive maintenance.
WHAT ARE THE STAKEHOLDERS TO BE INVOLVED IN ORDER TO ACHIEVE YOUR EXPLOITATION VISION?	Research partners and industry partners
DO YOU EXPECT TO HAVE REACHED A TRL HIGHER OR LOWER THAN 7 AT M42?	TRL 6-7
WHAT ARE THE EXPECTED STEPS IN YOUR GO TO MARKET STRATEGY?	Demonstration in the Digital Engineering Lab at Fraunhofer IAO.
WHO IS THE COMPETITOR?	Not known competitors, maybe Siemens or Dassault. For sure, maybe we shall consider the PTC (thingworx)/Ansys (Digital Twin builder) partnership and ESI (Simulation X - a commercial version of Modelica) which may be combined with ESI CAE software for process simulation.
NAME COMPETITIVE SOLUTIONS THAT ARE PARTIALLY OVERLAPPING WITH YOUR RESULT.	Nothing known yet.
WHO IS SELLING THESE PRODUCTS?	N/A
WHO ARE THE PARTNERS INVOLVED IN YOUR RESULT?	Brunel, End-Users.
HAVE YOU PROTECTED OR WILL YOU PROTECT THIS RESULT? HOW? WHEN?	N/A

GROUP 3: Z-BRE4K Platform connectors and ontology

Z-BRE4K ontology _ EPFL

EPFL EXPLOITABLE RESULT	Z-BRE4K ONTOLOGY
EXPLOITABLE RESULT NAME	Z-Bre4k Ontology
WHICH PROBLEMS ARE SOLVED	As of today, exploitation of advanced enabling technologies for monitoring complex equipment require integration capacity of heterogeneous data sources. In addition, its innovation lies on incorporation of various domains of knowledge. Z-Bre4k ontology facilitates a multidisciplinary approach through representation of domain knowledge with its concrete definition and provides semantic interoperability.
WHAT IS THE NEW ELEMENT OF THE RESULT THAT DISTINGUISHES IT FORM THE STATE OF THE ART?	Integration of physical entities, failure mechanism, related information and so on for predictive maintenance of equipment.
HOW BETTER IS YOUR SOLUTION (FASTER, CHEAPER, MORE RELIABLE, MORE EFFICIENT, WITH LESS UNDESIRED EFFECTS)?	Ability to explore industrial big data, because the algorithms we have today are not enough. Enrich big data through semantics, use semantical extraction of data, instead of going through raw data. With this semantic interoperability, you understand better, you can solve tasks faster and cheaper.
WHO WILL USE THE RESULT?	Since Z-Bre4k ontology is designed considering the use of end-users in the project and potential customers of the Z-Bre4k platform, it can be used by any businesses in maintenance domain. In addition, it also provides knowledge of domain, think tanks and policy intellectuals can exploit this ontology as a communication tool.

	The ontology is not exclusively for predictive maintenance, but for detecting and avoiding fails/ defects in manufacturing and get to Zero defects.
WHY SHOULD THE END USERS INVEST IN OR ADOPT YOUR RESULT?	To recognize semantic context of data brings values as follows: i) End users can easily recognize and identify the meaning of individual data and search meaningful data. ii) Software developers can harmonize data from various sources and request required data for each system components, and facilitate design of machine understandable entities on an intelligent engine iii) Requirements of end users can be satisfied since knowledge representation acts as a bridge between end users of a software platform and platform developers for design to meet requirements of end-users. OEM can also take this technology and they will design their own solutions since they develop/optimize the data acquisition architecture/output format, because they understand their own data.
WHAT ARE THE STAKEHOLDERS TO BE INVOLVED IN ORDER TO ACHIEVE YOUR EXPLOITATION VISION?	The target customers are companies from manufacturing and process industry sectors in future European or Swiss projects. In the future the content can be licensed and shared. ETH Zurich has participated in several Robotics projects. Today, Rapyuta Robotics is

	a spin-off of Cloud Robotics (PaaS). Same for Holonix (spin-off of Politecnico di Milano). Integrating results is considered, such as license as other and collaboration projects (contract collaboration). Holonix could be a very good relation to keep for future implementations.
DO YOU EXPECT TO HAVE REACHED A TRL HIGHER OR LOWER THAN 7 AT M42?	In order to facilitate implementation of the semantic component which is a backbone of Z-Bre4k platform, Z-Bre4k ontology should achieve TRL6 until M15. After enhancement and evolution of semantic modelling, it will achieve TRL7. To 7 it depends how it goes and they need to see if it could be implemented.
WHAT ARE THE EXPECTED STEPS IN YOUR GO TO MARKET STRATEGY?	The ontology will not be commercialized. However the Joint Venture will be a good opportunity to integrate the Semantic Modelling/Ontology. This ontology will be gathered with other ontology technologies and able to use under licenses permission. Consultancy services are also considered as well as collaborative project with Holonix or some other as part of their solution.
WHO IS THE COMPETITOR?	Since the ontology is defined as “collection of terms and relational expressions, together with definitions and axioms expressed in a computer interpretable language”, Z-Bre4k ontology should be enhanced and elaborated through think tanks and policy intellectuals instead of having competitors. *No competitors, but collaborators.*

NAME COMPETITIVE SOLUTIONS THAT ARE PARTIALLY OVERLAPPING WITH YOUR RESULT.	There is a lot of people who claim to have ML solutions, but they are not saying they are based on ontology, but organization platform to manage data. Is not competency but different approaches, collaborators
WHO IS SELLING THESE PRODUCTS?	The ontology will not be commercialized.
WHO ARE THE PARTNERS INVOLVED IN YOUR RESULT?	Besides EPFL, Holonix is the main leader of knowledge base system implementation, it is in charge of Z-Bre4k ontology with efforts of the other technical partners. In addition, end-users of Z-Bre4k provides the principle of ontology engineering in the form of competency questions.
HAVE YOU PROTECTED OR WILL YOU PROTECT THIS RESULT? HOW? WHEN?	Since the Z-Bre4k ontology will be published with the copy-right of EPFL, it does not require further IPR protection.

Autoware FIWARE DSA _ INNOVALIA

INNOVALIA EXPLOITABLE RESULT	**Autoware FIWARE DSA**
EXPLOITABLE RESULT NAME	INNOVALIA will develop the AUTOWARE architecture for the z-bre4k project and will provide new connectors for the International Data Spaces which will allow the exchange of data in a secure and controlled way. Thanks to this work new solutions and services will be provided by the Digital Shopfloor Alliance (DSA) a joint initiative by AUTOWARE, DAEDALUS and FAR-EDGE.

	Thinking about Zero breakdown solutions for predictive maintenance, two ideas to develop depending on the customers. 0. Big company: specific demonstrators in pilot lines (AIC, Smart factory…), offer some kind of functioning factory. 1. Small company: specific solution to their production plants, offering the option of including new platforms, modules, etc. in the future. From October 2019 zero defects applications too. We are working with another European initiative (Qu4lity) oriented to the development of zero-defects platform and solutions. We are planning to use this zero-breakdown architecture to apply it on the zero-defects initiative to ensure the perfect collaboration of both features.
WHICH PROBLEMS ARE SOLVED	The main objective of DSA is to provide a reliable, cost effective integrated platform to provide solutions and services to support small European enterprises, both in terms of customized and flexible applications. The three projects involved in DSA provide a complete CPPS solution allowing SMEs to access all the different components in order to develop digital automation cognitive solutions for their manufacturing processes. AUTOWARE provides a complete CPPS ecosystem, including a reference architecture that perfectly fits with the Far-Edge architecture, based on splitting the computing in the field, which allows a quicker response of the systems by eliminating the need of sending the data to a centralized computer. Furthermore, Daedalus defines an intermediate layer to synchronize and orchestrate the local processes. Finally, AUTOWARE also enriches the different technical enablers to make it easier to adopt CPPS by SMEs as well as reliable

communications and data distribution processes. Regarding the certification framework, it would allow the fast integration and customization of digital automation solutions. This approach proposes to go beyond a mere marketplace and provide an integrated approach that, on the development side, ensures the provisioning of qualified CPPS components, certified systems and solutions thereby reducing the integration and customization costs. Moreover, the operational conditions and performance expected from SoS operations can be managed in a controlled manner that ensures that machine and co-botic EU safety requirements can be addressed in the context of increased flexibility and system reconfiguration. On the demand side, the acquisition and operation costs are reduced based on shorter deployment cycles and customization on the basis of certified components already qualified with concrete working and development conditions. This means that due to the fact that z-bre4k architecture is based on AUTOWARE architecture, all the benefits mentioned above will also be effective for the z-bre4k project. The Digital Shopfloor Alliance for digital automation of SMEs could deliver the following assets:

- A digital automation ROI analysis framework (AUTOWARE).
- A digital marketplace to aggregate IEC-61499 solutions & applications (DAEDALUS). • Digital automation certification framework (AUTOWARE).
- Open fog & HPC infrastructure (AUTOWARE).

	• Digital automation services & development community (FAR-EDGE). • Digital automation ledger (FAR-EDGE). • Automation system components, robotics, control, vision (DAEDALUS+AUTOWARE). The International Data Space, also an essential part of Digital Shopfloor Alliance, fosters secure data exchange among its participants, while at the same time ensuring data sovereignty for the participating data owners. The International Data Space Association defines framework and governance principles for the Reference Architecture Model, as well as interfaces aiming at establishing an international standard for sharing data among different entities. Reduce the integration and deployment costs in factories. And it also allows a gradual deployment of Industries 4.0 (so that what we install today won't affect what we install tomorrow).
WHAT IS THE NEW ELEMENT OF THE RESULT THAT DISTINGUISHES IT FORM THE STATE OF THE ART?	AUTOWARE has been designed specifically with SMEs in mind. INNOVALIAs main contribution would be the extension of AUTOWARE OS, in order to provide a framework for the Z-bre4k initiative. Moreover, TAPPS is now being demonstrated in the context of CPS pilots. Z-Bre4k will allow that these assets are adapted to the needs of prescriptive and predictive analytics bringing them to realistic manufacturing lines and incorporating new elements like IDS connectors, which will allow the OS components to improve in reliability to TRL 7. Moreover, AUTOWARE is currently a unique platform in the market. Finally, in addition to all the benefits mentioned above, AUTOWARE as part of the Digital Shopfloor

	Alliance is compatible with the implementation of other products and services provided by DSA based on IEC-61499 standard. Why is it unique? Because from December 2018, a work group has been started within IDS with the purpose of designing an IDS for SMEs. Autoware is unique iniciative for 2 reasons: - Autoware's framework is very oriented to the services that the company integrates, which is a point of view very related to manufacturing more than technology itself. - It combines open platform with cloud applications. If you compare autoware with mindsphere, they offer also an API so you can work with their system, but they do not ensure that you won't have a gap when tried to connect others.
HOW BETTER IS YOUR SOLUTION (FASTER, CHEAPER, MORE RELIABLE, MORE EFFICIENT, WITH LESS UNDESIRED EFFECTS)?	As mentioned above, DSA and particular AUTOWARE is a unique solution specially focused on digitalization of SMEs. Currently, there is nothing similar to DSA in the market so there is no comparison to be done. Cheaper (especially regarding SMEs that don't have special interest in big company's platforms, because they prefer working with smaller businesses. Also interoperability, the concept of trust and sovereignty
WHO WILL USE THE RESULT?	In the case of INNOVALIA, final users will be SMEs which wants to digitize and introduce advanced automation solutions in their manufacturing processes. Big companies' strategies are different, we can try to attract them but not as a main platform to use. They can want our solution

	to help as “satellites” to other bigger solutions. We are more focused on SMEs, starting from metrology solutions. Once it is ready as metrology solution, we can canalize it through TRIMEK and try to be neutral. We want to keep the software through firewire foundation or IBS association. But we have some service model ideas: - Digital transformation consultancy (perform a diagnosis and give some advice) – 10.000 € for consult - Certificate and provide help with the deployment of these tools so the deployment is performed according to DSA conditions.
WHY SHOULD THE END USERS INVEST IN OR ADOPT YOUR RESULT?	The benefits that DSA offers for the different stakeholders are: • Manufacturing SMEs can adopt digital cognitive automation systems. • Automation and machine tool/robot providers can incorporate open CPS trusted platforms as part of an increased number of next generation smart production line components and solutions after component and system certification. • Developers of cognitive (learning, analysis, knowledge management capability services) and automation apps for autonomous service support can benefit from certified deployment and well characterized performance in open fog platforms. • Providers of cloud and HPC simulation and computation services that could host the operation of advanced cognitive services to complement edge operations. • Integrators and solution providers that built production line solutions for SMEs and OEMs faster and with more reliable components. All this is possible thanks to the Digital Shopfloor Alliance, the International Data Spaces and the framework provided by AUTOWARE OS to the z-bre4k project.

	Why should SMEs adopt this result (with the potential capabilities) if they are not digital-natives (lack professionals with ML/DL, cloud/HPC simulation, etc.)? How to get to SMEs that are not up-to-date with digitalization and new 4.0 technologies? Provide information and training through innovation hubs.
WHAT ARE THE STAKEHOLDERS TO BE INVOLVED IN ORDER TO ACHIEVE YOUR EXPLOITATION VISION?	In this particular case, the stakeholders in this project are GESTAMP, SACMI-CDS and PHILIPS which also are the use cases within this project. INNOVALIA is focused on developing new maintenance services and applications provided by DSA, specifically in extensions of AUTOWARE cognitive manufacturing platform, to support predictive maintenance smart services. INNOVALIA will adapt the AUTOWARE platform to each of these use cases.
DO YOU EXPECT TO HAVE REACHED A TRL HIGHER OR LOWER THAN 7 AT M42?	As we commented in the Grant Agreement (GA) we expect reach a TRL 7, so that is the aim of this project. Throughout the project, we will estimate if our prediction is correct or if we have to increase or decrease our expectations reaching other TRL values. Once we have the integration pilot, we can say we arrived TRL7. We will try to integrate it with TRIMEK. First try in their system the TRL6 and once it is tried in a whole production line TRL7.
WHAT ARE THE EXPECTED STEPS IN YOUR GO TO MARKET STRATEGY?	To reach TRL9 from TRL7, first of fall, we have to control all the data necessary to analyze the market. This information is: Trends, Porter's 5 forces, PEST, SWOT, Key stakeholders. All this data can be collected from: Press, Websites & Blogs, Influencers, Questionnaires, Analyst Reports and other sources. DSA proposes to go beyond a mere marketplace and provide an integrated approach including every service developed

	as an extension of AUTOWARE. As this is just a first approach to the go to market strategies all the other aspects will remain as they were planned in the Grant Agreement (GA). Firslty, we need the pilot development so we can show it. And now we are trying to develop an awareness campaign. If we want to offer consulting services, we need to catch people's attention. It is almost a commercial action what we need. In April we start visibility with European hub network and start creating alliances so we can amplify and get to SMEs.
WHO IS THE COMPETITOR?	Firslty, we need the pilot development so we can show it. And now we are trying to develop an awareness campaign. If we want to offer consulting services, we need to catch people's attention. It is almost a commercial action what we need. In April we start visibility with European hub network and start creating alliances so we can amplify and get to SMEs.
NAME COMPETITIVE SOLUTIONS THAT ARE PARTIALLY OVERLAPPING WITH YOUR RESULT.	At this stage of the project there are no solutions that can compete with Z-Bre4k. Besides the big ones, regarding open source, each of us is trying to solve specific problems, all of them different.
WHO IS SELLING THESE PRODUCTS?	As we have mentioned above, nowadays there are no direct competitors.
WHO ARE THE PARTNERS INVOLVED IN YOUR RESULT?	The Z-Bre4k architecture is designed and developed on the foundations of the AUTOWARE reference architecture and building blocks. Due to that reason, INNOVALIA is closely related to the 3 use-cases (SACMI-CDS, GESTAMP and PHILIPS).

	So, all the partners from the Z-Bre4k project will be involved in INNOVALIAs result.
HAVE YOU PROTECTED OR WILL YOU PROTECT THIS RESULT? HOW? WHEN?	As Digital Shopfloor Alliance is under development the measures to protect the results obtained have not been discussed yet. As the project continues protection measures of this result will be established.

IDS Connector _ INOVA+

INOVA+ EXPLOITABLE RESULT	**IDS Connector**
EXPLOITABLE RESULT NAME	IDS Connector
WHICH PROBLEMS ARE SOLVED	It might change during the project, because we don't know yet if we will be using it for all the segment, so far we are considering shopfloor
WHAT IS THE NEW ELEMENT OF THE RESULT THAT DISTINGUISHES IT FORM THE STATE OF THE ART?	• definition of generic types of devices/sources of data adaptable to Z-Bre4k (adaptable to different types of data) • NGSI compliance • embedment of specific system adapters (each use case) • focus on predictive maintenance.
HOW BETTER IS YOUR SOLUTION (FASTER, CHEAPER, MORE RELIABLE, MORE EFFICIENT, WITH LESS UNDESIRED EFFECTS)?	it is more directly applicable to predictive maintenance systems. *How are IDS Connectors more directly applicable to PdM applications?* The fact that is tailor made is the extra value. *Install it with some technical advice.*

	Is trusted data transfer/ownership the competitive advantage? Standard feature in most IoT platforms. The specific advantage is this tailor-made feature. Interprets data and translates the most suitable information.
WHO WILL USE THE RESULT?	Direct clients first answer, they consider these obvious customers. There are other data consumers.
WHY SHOULD THE END USERS INVEST IN OR ADOPT YOUR RESULT?	Trusted data transfer. Tailored solutions and technical assistance for deployment and maintenance/update.
WHAT ARE THE STAKEHOLDERS TO BE INVOLVED IN ORDER TO ACHIEVE YOUR EXPLOITATION VISION?	All partners implicated in the development. All farefront (developers): INOVA+, holonix, aimen, trimek.
DO YOU EXPECT TO HAVE REACHED A TRL HIGHER OR LOWER THAN 7 AT M42?	There are no factor preventing going from trl6 to trl7. Application itself will be the greatest challenge.
WHAT ARE THE EXPECTED STEPS IN YOUR GO TO MARKET STRATEGY?	It depends on the overall path for the entire consortium. It will be further defined.
WHO IS THE COMPETITOR?	Not known yet
NAME COMPETITIVE SOLUTIONS THAT ARE PARTIALLY OVERLAPPING WITH YOUR RESULT.	Maybe Siemens, Mindsphere, SAP Hana, PTC Thingwork, GE Predix, etc. have modules similar to IDS concept.
WHO IS SELLING THESE PRODUCTS?	Not Known

WHO ARE THE PARTNERS INVOLVED IN YOUR RESULT?	INNOVALIA, AIMEN, HOLONIX
HAVE YOU PROTECTED OR WILL YOU PROTECT THIS RESULT? HOW? WHEN?	No

GROUP 4: Data acquisition and visualization

Embedded Condition Monitoring compliance with IDS _ AIMEN

AIMEN EXPLOITABLE RESULT	**Embedded condition monitoring compliant with IDS**
EXPLOITABLE RESULT NAME	
WHICH PROBLEMS ARE SOLVED	Embedded condition monitoring compliant with IDS Framework for condition monitoring. Embedded system capable of obtaining data from different sensors (understood sensors as information and images) and transmit only important features for PdM (This would be customized depending on the requirements for each customer. Using infrared camera, we process this images and select the ones that we consider important and publish them. No repository so the information is not stored). We have implemented this in 2 hardware platforms with different application requirements. We can have different sensors, depending on the application. For the stamping press we read data, collected by the HMI and stored in a server. We apply ML algorithms to extract the relevant features and to structure the data in an understandable way in a data model that we have (can be modify). We publish the raw data, aggregate the structure data.

	We were only able to implement anomaly detection.
WHAT IS THE NEW ELEMENT OF THE RESULT THAT DISTINGUISHES IT FORM THE STATE OF THE ART?	The system, based on GPU, is suitable for deploying deep neural networks algorithms tailored to the specific applications, producing more robust data analytics, and is compliant with RAMI 4.0 and IDS standards. Novelty: interoperability, compatibility with Industry 4.0 applications through the implementation of the OPCUA server, and probably in the future with the IDS connector.
HOW BETTER IS YOUR SOLUTION (FASTER, CHEAPER, MORE RELIABLE, MORE EFFICIENT, WITH LESS UNDESIRED EFFECTS)?	This point is going to be further investigated thanks to the market analysis on the potential market for Z-BRE4K solution.
WHO WILL USE THE RESULT?	Research and Industrial partners. Within Z-BRE4K we are developing for Gestamp. It will be more useful for the operator, but the plant manager could also use the data.
WHY SHOULD THE END USERS INVEST IN OR ADOPT YOUR RESULT?	n/a
WHAT ARE THE STAKEHOLDERS TO BE INVOLVED IN ORDER TO ACHIEVE YOUR EXPLOITATION VISION?	We are working alone for the development of the components. Exploit it in other industries, industry 4.0. We would also use other platforms (like z-BRE4K) that delivers higher levels of industry 4.0 services. Brunel, that is developing predictive model. We have to decide which are the relevant features to use, if they can be exploited. Also, IMEC.
DO YOU EXPECT TO HAVE REACHED A TRL HIGHER OR LOWER THAN 7 AT M42?	Yes, it should be working by the end this year.
WHAT ARE THE EXPECTED STEPS IN YOUR GO TO MARKET STRATEGY?	The algorithms we are developing and the interoperability we are we are offering is applicable in different applications not only welding, we are developing a specific solution for welding, but it could be applied on every application. We are willing to use

	the PdM technology in different research fields. By the end of the project we can have a product that could be commercialized. We are collaborating not exactly to monitor defects, but we are working with a company that provides cameras, and we are selling solutions with them. But more focused on controlling the process of laser welding. The system is not completely developed yet, but our idea is to do the same with monitoring defects. We are making these first trials with Gestamp. We are trying to provide data not only for the surfaces, but also from inside.
WHO IS THE COMPETITOR?	n/a
NAME COMPETITIVE SOLUTIONS THAT ARE PARTIALLY OVERLAPPING WITH YOUR RESULT.	n/a
WHO IS SELLING THESE PRODUCTS?	n/a
WHO ARE THE PARTNERS INVOLVED IN YOUR RESULT?	It has not been decided yet.
HAVE YOU PROTECTED OR WILL YOU PROTECT THIS RESULT? HOW? WHEN?	

I-Like Machine _ HOLONIX

HOLONIX EXPLOITABLE RESULT	**I-Like Machine**
EXPLOITABLE RESULT NAME	I-Like machine Evaluation maintenance, maximize machine production, avoid critical conditions. Composed with 3 main parts: • Data gathering • Data storage ontological basis (semantics) + analytics, identify critical conditions (increase I-like machine value) • Data visualization dashboard

WHICH PROBLEMS ARE SOLVED	Within Z-Bre4k project HOLONIX aims at increasing the capabilities of "I-Like Machines" platform including in the suite a module for predictive maintenance. This tackle the need for maintenance optimization, going beyond the traditional approach based on preventive/corrective maintenance, which is characterized by long downtimes and high costs. Visualization dashboard It can stand alone or add other components (e.g. ML) to put in market.
WHAT IS THE NEW ELEMENT OF THE RESULT THAT DISTINGUISHES IT FORM THE STATE OF THE ART?	The condition monitoring module for predictive maintenance will be based on ontology and will include a knowledge-based system with rules to identify the status of the components/systems forming the machine • *Model: predictive capabilities* • *Novelty: extract data to identify critical conditions* *How to implement it? Two different options* - *Long-term collaboration with EPFL (ML + ontology)* - *Internally develop predictive capabilities*
HOW BETTER IS YOUR SOLUTION (FASTER, CHEAPER, MORE RELIABLE, MORE EFFICIENT, WITH LESS UNDESIRED EFFECTS)?	Predictive maintenance based on condition monitoring is object of research, but there are still no effective solutions on the market. The solution here developed will be integrated in a commercial platform (Holonix I-Like machines) guaranteeing a rapid readiness for the market. The semantic framework used for the module will favor interoperability of the systems. K-B (knowledge – Base) System less time needed for ML Solution will be more mature
WHO WILL USE THE RESULT?	Customers who purchase it. Industrial machine manufacturers are our main potential customers. The product is thought to answer the need of machines producer to

	gather and monitor data from their machines (to improve reliability and maintainability of the system), but also to endow their machines with a tool able to help their customers in performing maintenance (scheduled and unscheduled). Thus, with Z-Bre4K project new features will be given to i-Like machines to better accomplish these functionalities. I-Like machines will be sold as a product + licenses for s/w maintenance. The "new functionalities" can be added also as additional features to the products already sold to our customers. - Machine operators who interact with the machine - Plant managers → Maintenance plan, monitoring the conditions - Machine producers The solution will be implemented as follows: HMI → Visualization of ML results through a dashboard. For that collaboration with ML experts, still flexible (Brunel is an option). ML will be on cloud. Segmentation: - For machine producers: gather data, track components and redesign. - For machine users: visualization, upper layers more interesting.
WHY SHOULD THE END USERS INVEST IN OR ADOPT YOUR RESULT?	The end users will profit from the possibility to have an effective tool for predictive maintenance, enabling them to optimize maintenance procedures, reducing downtime and costs.
WHAT ARE THE STAKEHOLDERS TO BE INVOLVED IN ORDER TO ACHIEVE YOUR EXPLOITATION VISION?	Machine producers and users.
DO YOU EXPECT TO HAVE REACHED A TRL HIGHER OR LOWER THAN 7 AT M42?	We expect a TRL 7 or higher
WHAT ARE THE EXPECTED STEPS IN YOUR GO TO MARKET STRATEGY?	Validation of the product by various pilot customers; empowerment of our sales

	network to reach new markets for our platform; development of a proper marketing strategy. All these steps will be accomplished maximum in 2 years after the end of the project.
WHO IS THE COMPETITOR?	IoT companies that integrates condition monitoring with predictive algorithms
NAME COMPETITIVE SOLUTIONS THAT ARE PARTIALLY OVERLAPPING WITH YOUR RESULT.	C3 IoT platform; Uptake; SpaceTime Warp 6 Platform
WHO IS SELLING THESE PRODUCTS?	Start-ups, but also large companies such as IBM, SAP or SIEMENS are investigating their own solutions.
WHO ARE THE PARTNERS INVOLVED IN YOUR RESULT?	EPFL and BRUNEL, CORE / IMEC → possible partner for ML
HAVE YOU PROTECTED OR WILL YOU PROTECT THIS RESULT? HOW? WHEN?	Trade secret will be the preferred option for protecting the results

In-machine Metrology_ TRIMEK

TRIMEK EXPLOITABLE RESULT	**In-machine metrology**
EXPLOITABLE RESULT NAME	In-machine metrology linked with quality inspection – new M3 platform functionalities. Sensor + platform M3. All the information from scanning on the machine to data analysis, point clouds, statistics; and makes use of the cloud's capabilities. They want to integrate the PdM to this platform for zero breakdowns. But the important thing for the clients is that it is done inline, in the production line. Hardware is inline sensor to internally measure the quality of the product, being able to measure ALL the products (because it is very fast)).
WHICH PROBLEMS ARE SOLVED	TRIMEK will provide a new service by implementing new functionalities within the M3 platform to support predictive maintenance operations and in-line metrology equipment. The acquisition of the necessary data will produce an improvement of the prediction of unexpected machine

	breakdowns or deviations, saving money and time. Currently the metrology is performed in the lab, which requires time and parts waste. The purpose of ML is that equipment can offer zero breakdowns, access to quality data and constant production, which improves the learning and enrichment of productive process. M3Box is Holonix' I-like-machine's equivalent. Semantics, data process and visualization. It also will provide data, specially about quality, to offer zero defects.
WHAT IS THE NEW ELEMENT OF THE RESULT THAT DISTINGUISHES IT FORM THE STATE OF THE ART?	In particular, the M3 platform will incorporate **new software modules** and **functionalities** which will permit to extend this platform to provide predictive estimations and metrology modules for in-line equipment. In particular, the M3 Workspace and M3 analytics functionalities will be enhanced for implementation of maintenance specific service modules supported by QIF 2.0 NIST standard. Two maintenance types: verification (of the machine state, the worker should check every day) and correction/calibration. A good calibration can last 2 years.
HOW BETTER IS YOUR SOLUTION (FASTER, CHEAPER, MORE RELIABLE, MORE EFFICIENT, WITH LESS UNDESIRED EFFECTS)?	This innovative solution will allow to fuse inspection and metrology for precise predictions and more efficient and accurate measure and data analysis. Moreover, it is possible to use it anytime and anywhere and by means of a simple computer or tablet with low computational capacities. More precise (which none of the current solutions are) and efficient. Correlate the machine status verification data with the sensors (condition monitoring). With this data, create the algorithms. The most important part are the metrology data and the deviation graphs, so you can see and control the zones, parts, processes with more defects.

WHO WILL USE THE RESULT?	In the case of TRIMEK, final users will be all industries that will be interested in this new service, especially the automotive sector. Any manufacturing plant is a potential user: automotive, railway, aerospace, machine-tool, etc. Any plant with safety restriction.
WHY SHOULD THE END USERS INVEST IN OR ADOPT YOUR RESULT?	Z-Bre4k will exploit metrology information as well as point clouds of the products to build applications for Zero break down of inline quality control equipment. It is also useful for predictive maintenance services for smart and fast machine verification and condition monitoring. TRIMEK's solution is a powerful tool to early detect and prevent unexpected breakdowns managing all the necessary data provided by the inline quality inspection equipment. This early prediction and managing will save time due to a non-operational machine and hence, save money. In addition, the users of the solution will be the factory blue collar workers through a friendly program interface. *How will this early detection/prevention will be done?* A) Trimek data combined with other Gestamp info (welding, mechanical press) for ML analysis for PdM? B) Setting metrology thresholds for critical quotes for quality/failure assessment? (Condition monitoring approach (rather preventive)) *How this will affect your go-to-market structure?* *What you interface will look like?* It offers you a previously inexistent product in the market: online predictive maintenance of the machines. The PdM will also be used in the production line data. It will offer the visualization of the data with a user-friendly interface.
WHAT ARE THE STAKEHOLDERS TO BE INVOLVED IN ORDER TO ACHIEVE YOUR EXPLOITATION VISION?	In this particular case, the stakeholder in this project is GESTAMP which is also a use case within this project. TRIMEK is focused on the integration of hardware and software tools and the development of the strategies for maintenance inline equipment. In short, TRIMEK will collaborate in the assessment of

	GESTAMP advanced manufacturing process to be deployed at the AIC smart factory line. *Thinking out of the(Z-BRE4K) box, which other stakeholders will be involved? i.e.: NIST, other automotive tier suppliers, automotive OEMs? Aerospace OEM/tier suppliers? Railway OEM/tier suppliers?* *For which specific application do you think that your M3 platform could be useful?* *And which is each stakeholder's role and areas of action and how they are connected to the exploitation of your results.* Industrial sectors (automotive, machine-tool, aerospace, railway, etc.).
DO YOU EXPECT TO HAVE REACHED A TRL HIGHER OR LOWER THAN 7 AT M42?	TRL7
WHAT ARE THE EXPECTED STEPS IN YOUR GO TO MARKET STRATEGY?	As we commented before, our intention is reach TRL 7 as soon as possible with guarantees of success. Current M3 platform deployed in clients is at TRL9. During the project, TRIMEK will extend and enhance M3 Workspace and M3 analytics functionalities for implementation of maintenance specific service modules so the project will bring these M3 Workspace new predictive maintenance analytics and support services to TRL7 level. To reach TRL9 from TRL7, first of fall, we have to control all the data necessary to analyse the market. This information is: the size of the market, Trends, Competitors and substitutes, Porter's 5 forces, Critical Success Factors, PEST, SWOT, Key stakeholders. All this data can be collected from: Press, Websites & Blogs, Influencers, Questionnaires, Analyst Reports and other sources. From our point of view, the key value proposition of the Z-BRE4K solution is an integral platform that offers innovative and customized solutions for all the unexpected machine factory breakdowns through advance cognitive maintenance strategies. For TRIMEK, the standalone value consists of generating a close loop integration of all related actors by integration of dimensional quality control to optimize in-line equipment, M3 platform and process planning. Thanks to this project,

	TRIMEK will develop new software modules adapted to predictive maintenance which will be directly included in our portfolio of dimensional quality services. Finally, TRIMEK can offer this Hardware scanning and Software tools as a service.
WHO IS THE COMPETITOR?	Due to the ambition, the novelty of this project and the search of different IPs we could not find any competitor in this field. However, if we consider only the metrological measurements, there are other competitors. The metrological industry is based on three principal offers such as metrological equipment, measurement software and services. The metrological equipment sector is quite limited, with highly specialized competitors that often become partners to provide products and cooperate in the development of new ones. In this way, the manufacturing processes that require complex measurement systems require components from several companies, such as the cases of LEICA, NIKON, ZEISS, etc. Brief descriptions: LEICA. World leader in microscopy equipment, cameras and analysis software. Highlights PC-DMIS for component inspection and PolyWorks for point cloud analysis and reverse engineering. NIKON. Manufacturer of vision equipment and image analysis software. Among its products, Focus Inspection stands out for the comparison of real data with CAD models. ZEISS. An important company in the fields of medicine, nanotechnology, industrial metrology and microscopy. It is one of the market dominators, both in equipment and software. Between his range of products they emphasize: Calypso, (oriented to the analysis of the characteristics of the analyzed components); Caligo (analysis of surfaces) and Gear Pro (Inspection of cogwheels).
NAME COMPETITIVE SOLUTIONS THAT ARE PARTIALLY OVERLAPPING WITH YOUR RESULT.	At this stage of the project there are no solutions that can compete with Z-Bre4k.

WHO IS SELLING THESE PRODUCTS?	As we commented above, actually there are no direct competitors.
WHO ARE THE PARTNERS INVOLVED IN YOUR RESULT?	As we are in close relationship with the quality control of use case 2, our principal partner is GESTAMP. On the other hand, we are indirectly related with FRAUNHOFER, CRIT, INNOVALIA and HOLONIX.
HAVE YOU PROTECTED OR WILL YOU PROTECT THIS RESULT? HOW? WHEN?	At component level we have to develop 3D Scanning and Metrological point cloud analysis software for Zero defect and Zero breakdowns in industrial factories. Furthermore, we have to develop the new functionalities and modules for the M3 Platform. As conclusion, TRIMEK will produce proprietary software components which will be offered as a service within the Z-BRE4K platform. TRIMEK intends to protect the technology with software licenses. For now, the most likely option is to write a patent. Everything will be related with software models, but if we create a hardware (for example, the machine), a patent could be used to protect it. It is still an issue to discuss.

GROUP 5: Original equipment manufacturers

CCM Machine with predictive maintenance capabilities _ SACMI

SACMI EXPLOITABLE RESULT	CCM machine with Predictive Maintenance capabilities
EXPLOITABLE RESULT NAME	CCM machine with Predictive Maintenance capabilities
WHICH PROBLEMS ARE SOLVED	Starting from three specific mechanical modules of the CCM machine (Thermal Regulator, Hydraulic Unit, Plastic Extruder), SACMI will provide its customers (plastic closures manufacturers for the beverage sector) with Predictive Maintenance services such as Remaining Useful Life (RUL) and

	automatic Failure Mode identification based on operating data of the machine. The new machine may be connected to higher levels of shopfloor automation (i.e.: MES, ERP) for operation optimization (maintenance scheduling, coordination, adaptation, etc.)
WHAT IS THE NEW ELEMENT OF THE RESULT THAT DISTINGUISHES IT FORM THE STATE OF THE ART?	A dedicated SW/HW infrastructure will implement RUL and failure diagnosis, going beyond the current-art, preventive maintenance approach. An optimized balance between edge computing and cloud-analytics will be carried out.
HOW BETTER IS YOUR SOLUTION (FASTER, CHEAPER, MORE RELIABLE, MORE EFFICIENT, WITH LESS UNDESIRED EFFECTS)?	"CCM are most probably the best-quality technology for Plastic Closure Manufacturing. CCM machines are equally highly reliable. PdM-capabilities enhancement will enhance the optimization of spare parts management and will reduce the duration of maintenance operations based on a machine-learning, data-driven analysis."
WHO WILL USE THE RESULT?	Plastic closure manufacturers for the beverage industry
WHY SHOULD THE END USERS INVEST IN OR ADOPT YOUR RESULT?	Better State of Health and Remaining Useful Life Awareness through PdM enhanced Maintenance Operations. Will result in significant OPEX savings (maximize machinery uptime) with limited upfront CAPEX increase.
WHAT ARE THE STAKEHOLDERS TO BE INVOLVED IN ORDER TO ACHIEVE YOUR EXPLOITATION VISION?	"1. Single sensors and IoT sensor platform providers, 2. IoT Gateway SW/HW providers (in case of old versions of CCM), 3. PdM software/services providers (i.e.: PTC, Siemens, SAP, Software AG, Seebo, etc.) and/or Z-BRE4K/FIWARE platform providers (as a whole or separate) 4. Machine learning algorithm providers (Universities, Research Centers, Companies)"

DO YOU EXPECT TO HAVE REACHED A TRL HIGHER OR LOWER THAN 7 AT M42?	We expect so, working prototype at customer site (CDS)
WHAT ARE THE EXPECTED STEPS IN YOUR GO TO MARKET STRATEGY?	"1. Develop the solutions for Z-BRE4K 3 use cases (EX, TH, HU) within CDS plant 2. Commercialise Z-BRE4K solution to other customers 3.1 Develop PdM solutions for other modules within the CCM (i.e.: product quality, molds) 3.2 Develop PdM solutions for other SACMI machinery (i.e.: closure bender) within closure division 3.3 Develop PdM solution for other SACMI machinery apart from SACMI Closures division (i.e.: ceramics, beverage) 4.1, 4.2, 4.3: Commercialize solutions developed within 3.1, 3.2, 3.3"
WHO IS THE COMPETITOR?	Other plastic closure machinery manufacturers investing in data-drive PdM solutions.
NAME COMPETITIVE SOLUTIONS THAT ARE PARTIALLY OVERLAPPING WITH YOUR RESULT.	n/a
WHO IS SELLING THESE PRODUCTS?	Other OEMs that sell machines like SACMI
WHO ARE THE PARTNERS INVOLVED IN YOUR RESULT?	The suppliers of sensors, algorithms and software for predictive diagnostics
HAVE YOU PROTECTED OR WILL YOU PROTECT THIS RESULT? HOW? WHEN?	If new relevant very innovative solutions will be generated, then a Patent will be filled.