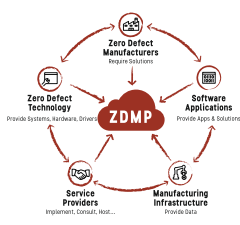




Welcome to the 6th newsletter of the **ZDMP** project – **Zero Defects Manufacturing Platform**

ZDMP Overview



Zero Defects Manufacturing Platform (ZDMP) is a European initiative launched in 2019 in the framework of Horizon 2020 which concluded in June 2023. The main concept of the project is to address the quality aspects of highly interoperable industrial environments contributing to the domain zero defects.

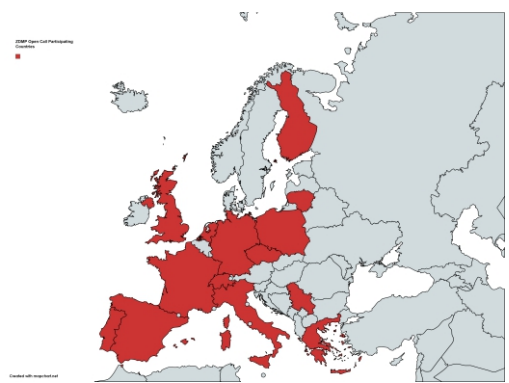
Modern industrial environments are enriched with sensors that harvest data about manufacturing processes. This data can be turned into powerful sources of knowledge to improve the quality of these industrial processes and products. Moreover, to support this, issues related to interoperability, connectivity and integration with 3rd parties' systems have to be tackled.

The ZDMP ecosystem addresses these issues through a set of innovative technological solutions to support zero defects within digital manufacturing. Such solutions are provided in modular way and are called zComponents and zApps. zComponents offer more generic functionalities that can, for instance, support the interoperability through the set of APIs, whilst zApps are more narrowly focused satisfying the needs of, for instance, very specific application domains and thus using, and complementing, zComponents.

ZDMP considers use-cases from four domains: Automotive, Electronics, Construction and Machine Tools Manufacturing. However, ZDMP is not limited to these domains, and indeed it has already extended its domain coverage by use-cases from the Open Call sub-projects launched to enrich and validate the ZDMP ecosystem.

Open Calls

ZDMP provided financial support of 3.2M€ to 28 consortia with members from 14 EU and associated countries:



During 2022, Open Call Winners demonstrated their results and identified their impact. There were 3 types of the Open Call sub-projects. Group 1 aimed at Validation and testing of the zComponents and zApps developed by the ZDMP consortium in industrial use-cases/scenarios. Group 2 addressed Development of new zApps that could complement the existing zApps and zComponents in terms of provision of missing functionalities, for instance, to have a customised solution for a specific application domain. Group 3 addressed the Integration of zComponents with already existing platforms or solution to enhance their capabilities.

The Open Call subprojects have resulted in 18 new applications and 3 new components available to EU manufacturers via the ZDMP/i4FS Marketplace, with offerings available in 13 additional sectors beyond the project pilot domains. This means 75% of all subprojects (21 of 28) resulted in a marketplace offering. In addition, 2 existing products were enhanced through ZDMP integration. The four validation

subprojects resulted in 6 validation reports, which directly led to the creation of "miniZDMP" by the ZDMP Consortium for OnPremise, lightweight installation and deployment – a vital part of the ZDMP offering.

ZDMP Pilot Sectors

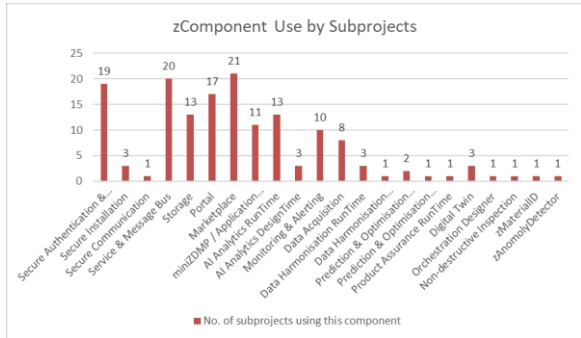
- Automotive
- Construction
- Machine Tools
- Electronics



Open Call Sectors

- Additive 3D Metal Printing
- Metalworking & Metal Fabrication
- Lot-size One Manufacturing
- Factory Planning
- Food & Beverage
- VR/AR I4.0 Solutions
- Plastics
- Furniture Production
- Robotics
- Cosmetics / Pharma
- Aerospace
- Medicine
- High-tech Materials (carbon, ceramics...)

All subprojects made extensive use of ZDMP zComponents, including the Validation projects, which were able to validate and report on up to 15 different zComponents in 4 different validation scenarios. The intensity of particular zComponents usage is provided below:

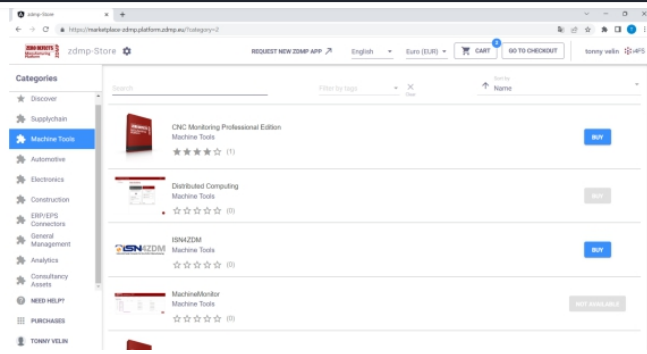


All technical partners of the ZDMP consortium, both technology providers and research institutions, have cooperatively contributed in building the ZDMP ecosystem. For example, later the newsletter reports the practical experience of partner Video Systems.

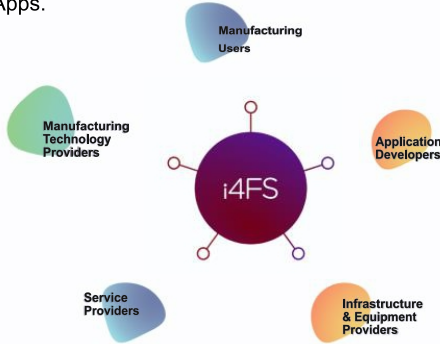
Open Call Results Exploitation

The growing area of zero defects manufacturing has much potential for the developers of Zero Defects Manufacturing (ZDM) solutions. There is still a lack of tools and solutions, as well as platforms that connect and provide networking capabilities for ZDM solution developers and industrial partners. ZDMP aims at covering this gap by providing to the ZDM ecosystem software components, a platform, and a digital marketplace where the ZDM solutions can be acquired. The idea is that the developers address the demand coming from manufacturers and provide applications that can be sold on the digital marketplace. The scope of the solutions developed in the course of ZDMP includes solutions for Data Acquisition and Analytics, Process Quality Assurance, Product In-line Defect Prediction.

Using the ZDM environment, manufacturers have the opportunity to acquire ZDM solutions relying on proven software components aligned with their needs. Moreover, the manufacturer has the option to choose where to deploy and run applications, either InCloud or On Premise. On the other hand, developers have access to the ZDMP digital platform containing the tools and software components that can be used to develop applications on top of them.



To manage and maintain the marketplace, and the corresponding software components the company i4FS (Industry 4.0 Factory Solutions) was established by several project partners and which became a project beneficiary. Responsibilities of i4FS include: platform operation and maintenance, sales support, technical support to customers, services for training and certification, services for customization of ZDM solutions, and services for hosting. In other words, the i4FS marketplace offers environment for developers to easily develop, market and sale factory apps and, on the other hand, manufacturing customers get an access to one-stop-shop for industrial Apps.



Some of the software components on ZDM platform are free-of-charge others can be purchased. At the current moment there are options for acquiring the ZDM solutions as: subscription model (monthly or yearly), one-time-purchase model and trial-period model.

One possible exploitation scenario is:

- Manufacturer chooses a specific solution and selects an available acquisition option (subscription, one-time-purchase, trial period) that can vary from solution to solution;
- Selected solution is then customized to the manufacturing user needs, paying for customized software development;
- If the manufacturer selects i4FS as a cloud provider, as opposed to hosting on its Premises, the manufacturer pays the price set by i4FS.

As at 2023-Q2, the ZDMP/i4FS Marketplace has:

- 32 open source software components focusing on process and product quality that can be used as building blocks to develop Apps.
- 52 Apps developed by ZDMP partners or by Open Call winners covering a wide range of industrial problems.
- A number of Apps developed through other projects (e.g. i4Q – <https://www.i4q-project.eu/>) focusing on data quality to provide functionalities that are missing on the marketplace.

To discover more about the i4FS visit: www.i4fs.com

Contact point for sales and administration issues: info@i4fs.com

Contact point for technical support: support@i4fs.com

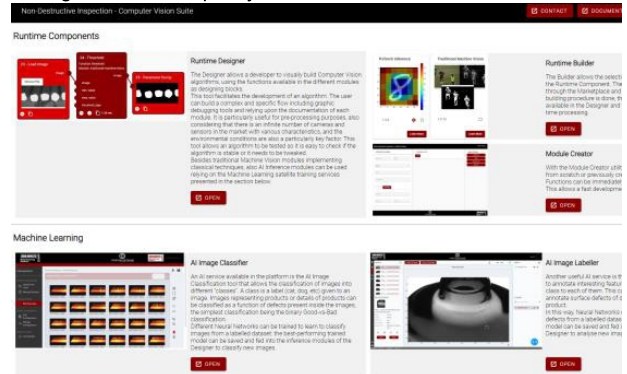
Technological beneficiary's experience



Video Systems Srl is a SME located in Italy, providing artificial vision (AV) technologies for quality control and monitoring in manufacturing sectors. Within

the ZDMP project, Video Systems built an advanced quality inspection development suite, called Non-Destructive Inspection – Computer Vision (NDI-CV), based on AV tools. The NDI-CV suite extends the quality control functionalities and integrates them into the ZDMP platform. The final solution combines a graphical tool for defining and

testing image processing workflows enhanced with AI capabilities for image classification and annotation and enabling the development of sophisticated image analysis solutions for quality control in manufacturing. The validity of the NDI-CV suite has been demonstrated through successful pilot projects, which highlighted the solution's effectiveness in addressing quality control challenges and showcasing its value in real-world manufacturing scenarios. Building on this success, Video Systems has applied the solution to other use-cases, enabling the rapid development of tailored solutions for object counting and surface quality control in mechanical environments.



By utilizing the proposed AV based solution, manufacturers can achieve significant improvement in quality control. The graphical tool provides an intuitive interface for users to define and customize image processing workflows, based on functional processing blocks. This allows for the seamless integration of various image enhancement techniques, feature extraction algorithms, and quality assessment methods, tailored to the specific requirements of different manufacturing environments.



The image above represents the process of interface design for the analysis of shape conformity of a steel tube performed in the framework a project's use case. The integration of AI tool further enhances the capabilities of this AV solution, namely powerful algorithms and deep learning models allow the AI tool for accurate classification and image annotation, providing valuable insights into product defects and deviations from desired quality standards. By training the AI tool on specific datasets, it can automatically detect and flag potential quality issues, streamlining the inspection process and ensuring consistent and accurate assessments.

The NDI-CV suite supports the Software as a Service (SaaS) model enabling its simplified integration with basic ZDMP services like authorization, data storage and exchange, which seamlessly rely on existing manufacturing IT infrastructures. This further streamlines the implementation process and enables manufacturers to rapidly adopt and benefit from the solution capabilities in addressing quality control-related challenges, such as: graphical image processing workflow tool and AI tool for image classification and annotation. These analytical tools showcase the vast potential that AI unlocks in the realm of quality control, leading to improved product quality, enhanced efficiency, and increased customer satisfaction. All this opens up new opportunities for various industries relying on image processing and analysis for quality control.

Open Call Sub-Projects

Below is a sample of the innovative subcall projects that ZDMP enabled in the fields of Validation, Development, and Integration.



HOPU is specialized in developing IoT-based solutions for measuring air quality in urban and industrial ecosystems. HOPU integrates high-quality sensors into its devices, assembled in its in-house workshop. In the framework of the Open Call, the company has successfully tested the following zComponents and zApps: zImageAnnotator, zAutomaticMaterialOrdering, Monitoring and

Alerting, Digital Twin, AI Analytics Runtime, zRemoteQC and zMaterialID. The following KPIs were considered:

- Reduction of assembly time: The time required for manufacturing decreased through automatic data collection, annotation, and binding the different phases.
- Reduction of time spend on quality control: This is accomplished through the zComponents that assist the quality technician during the quality check process.
- Reduction of failure rate of devices: This is accomplished through the early failure detection during the quality control process, so that the number of failures decreased.
- Digitalization of the production process: The data collected during the manufacturing process is annotated and more efficiently processed.

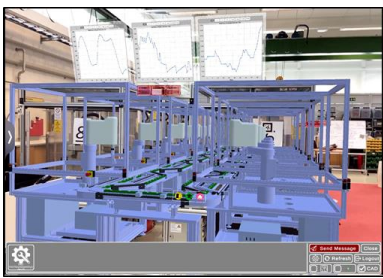
The outcomes of ZDMP components utilization demonstrated a high impact on commercial exploitation in the real-world production use-case.



Allbesmart developed an Augmented Reality (AR) based maintenance service solution to achieve zero-defect manufacturing. The solution is a new zComponent (zAR), integrated with the ZDMP platform to visualize ZDMP platform data. This solution ensures the overlay of information on industrial machine and equipment facilitating correct maintenance, training and optimal use of the equipment and thereby contributing to the zero-defect objective. Specifically, zAR ensures the following:

- Reduction of maintenance errors and machine downtime
- Reduction of cost of training
- Increase of worker safety and machine lifetime

The solution was tested locally at a one of Allbesmart's customer's site (Stoneshield), using a robotic machine (robotic seal inserter) and remotely at the experimentation facility, using the FASTory assembly line of ZDMP Partner Tampere University. The goal was to demonstrate the use of zAR in an industrial environment. In both use cases, the 3D CAD models of the machines were uploaded to the zAR web interface for the purpose of calibrating and creating the augmented reality environment. This was to ensure the proper representation of key machine information (ie machine information, sensor data, tutorials, APIs, etc.) in the augmented reality environment. The calibration task is important for the display of holograms and information about the real assets in relation to their actual and correct positions in the real environment. In the validation phase, the zAR application was utilized for training the operators to use and maintain the equipment.

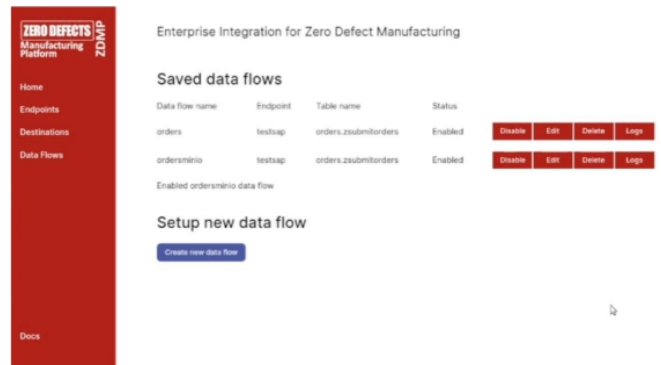


The experimentation occurred over a 9-month period and a 100% accuracy on the representation of the sensing data of the machines through 3D holograms was achieved. The human training time was also reduced by 50%. Lastly, human-caused errors were reduced by 80% specifically for the Stoneshield use-case.



Integration projects were the third grouping of Open Call sub-projects, a success story is from FORCERA.

The goal of the sub-project was to develop an intuitive, efficient, and bi-directional integration component between Enterprise Information Systems (EIS), such as Enterprise Resource Planning (ERP) systems, with the ZDMP ecosystem. The final product of the sub-project is the EZD (Enterprise Integration for Zero Defect Manufacturing) - an integration zApp allowing fast and intuitive data exchange between the two systems. EZD supports the Industry 4.0 strategy contributing to integration of heterogeneous factory systems into one unified platform.



For validation purposes, EZD functionalities were tested in a real-world scenario enabling ZDMP to receive production order data from an ERP that can be used to trigger shop-floor automation. This process is used to demonstrate the downstream (ERP to ZDMP) data flow functionality. Once the production process is complete, considering the parameters given by the original production order request, ZDMP tools can be utilised to send an upstream response to the ERP to provide order confirmation as well as other production parameters. As a part of the demonstration scenario, FORCERA created two custom SAP ABAP programs used for the showcase: One for submitting the production order and other to check the production order status. It was demonstrated successfully that EZD allows configuration of the communication channel in less than 2 minutes, as well as perform the data fetching job configuration in less than 10 minutes. No data loss between the two systems were observed.

DMIS 23

Creating impact was an important aspect for the project's results. ZDMP recently initiated and delivered an action which culminated with the organization of the Digital Manufacturing Industrial Summit (DMIS) which took place in Valencia from 25th to 27th of April 2023 (check video <https://www.youtube.com/watch?v=vphc3MJUK3w>). The event was jointly organized by ZDMP and other research and innovation projects funded by EU, and has attracted 250 participants. DMIS offered a great discussion platform facilitating networking among manufacturers, developers, researchers and policy makers and enabling them to learn about ZDMP and other activities. Among the notable subjects discussed it included zero defects, data quality, digital platforms, digital marketplaces, Artificial Intelligence, Sustainability and many more.

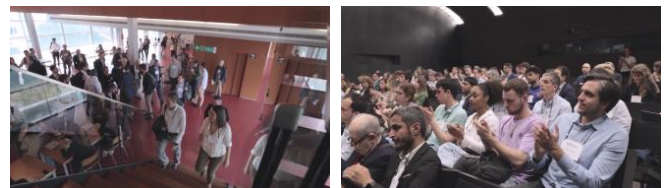


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Furthermore, the cornerstone was the discussion of manufacturing transformation towards Industry 5.0. Such manufacturing transformation is critical for European industry to maintain its leading world position as a producer of high-quality products. At the same time, it is important to ensure the sustainability of manufacturing, which covers not only the issues of efficiency improvement, but also the social and ecological aspects. ZDMP has used this event to demonstrate the technological advancements achieved during the project and how they can help transform the manufacturing landscape. More information about the event can be found at dmis2023.org



Thank you very much for your interest in the ZDMP Project (H2020-825631)

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