

KYKLOS 4.0 newsletter #3

KYKLOS 4.0 – <https://kyklos40project.eu>

October 2021



An Advanced Circular and Agile Manufacturing Ecosystem based on rapid reconfigurable manufacturing process and individualized consumer preferences



In this edition of the KYKLOS 4.0 Newsletter, discover the latest news about the project, including the developments of the KYKLOS 4.0 components and their contribution to Circular Manufacturing, the results of the KYKLOS 4.0 Open Calls as well as an overview of KYKLOS 4.0' latest events

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The project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 872570



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1. KYKLOS 4.0 Circular Manufacturing

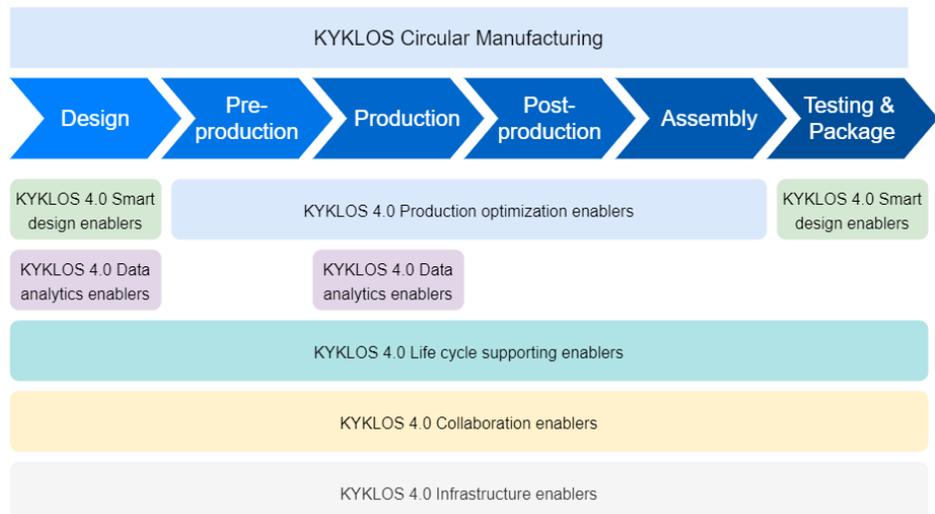
KYKLOS 4.0 platform aims at providing **circular manufacturing** capabilities in the form of software, hardware, and methodological services to support the whole circular manufacturing process, from the design of the product until the testing and packaging of it.

There are seven types of components in the KYKLOS 4.0 platform:

1. **Smart Design enablers:** Support the design of the customized products in terms of best materials selection, best specification sizes and orientation or simulation of the final product.
2. **Production Optimization enablers:** Monitor in real-time the production and provide simulation of the process in case some of the inputs change.

3. **Data Analytics enablers:** Support components 1 and 2 by providing Artificial Intelligence (AI) based services.
4. **Life Cycle Supporting enablers:** Cover the whole life cycle of the circular manufacturing, by providing environmental and sustainability related Key Performance Indicators (KPIs) monitoring.
5. **Collaboration enablers:** Promote the data sharing among different KYKLOS 4.0 components.
6. **Infrastructure enablers:** Offer a common and shared repository that supports heterogeneous data, an interoperability layer to gather all this data, a common Graphic User Interface (GUI) to the KYKLOS 4.0 Ecosystem for the end users, and authentication and authorization services.
7. **Outreach enablers:** Promote the capabilities that the KYKLOS 4.0 platform can provide to the end users.

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2. KYKLOS 4.0 Pilot Use Cases

Within KYKLOS 4.0 project, 8 use cases are being implemented to validate the **KYKLOS 4.0 components** and their ability to contribute to **circular economy activities**.

Concretely, we estimate that the KYKLOS 4.0 case studies are aligned with **circular economy business models** and represent clear practices of Information Technology (IT) support for transitioning from linear to circular value chains in manufacturing industries.

KYKLOS 4.0 innovations help stakeholders better understand and quantify possible benefits for their companies in economic and

environmental terms, contributing to their competitiveness and resilience in an economy of finite resources.

The following **8 Smart and Circular Manufacturing Pilot use cases** are being developed to demonstrate the matching and applicability of KYKLOS 4.0 technologies and solutions to major categories of businesses and manufacturing processes:

- **Medical**
- **Aerospace**
- **Electronic devices and equipment**
- **Shipyards**

- **Food Industry**
- **Automotive**

Furthermore, KYKLOS 4.0 technologies and use cases are engaged to **support SME innovators** in digital Manufacturing through the **Open Calls**, the first round of which closed on June 2021.

The Open Calls enable stakeholders and technology providers to get a deeper understanding of how **KYKLOS 4.0 capabilities** are applied to **real-world use cases**.

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"8 Smart and Circular Manufacturing Pilot use cases are being developed in the project."


KYKLOS 4.0 Smart and Circular Manufacturing Pilots

01 Medical Pilot PRO MEDICARE facilities – Italy	05 Electronic Equipment Pilot CONTINENTAL facilities – Romania
02 Aerospace Pilot KANFIT3D facilities – Israel	06 Shipyards Pilot ASTANDER facilities – Spain
03 Aerospace Pilot GRC facilities – Israel	07 Food Industry Pilot PINDOS Cooperative facilities – Greece
04 Electronic Devices/Equipment Pilot VESTEL facilities – Turkey	08 Automotive Pilot DIGRO facilities – Italy



3. KYKLOS 4.0 Components' contribution to Circular Manufacturing

The implementation of Pilot Use Cases is based on KYKLOS 4.0 components that are developed to support pilots and end users in multiple phases of their **circular manufacturing** processes. Among the technical components used to facilitate pilots capabilities, there are two with outreach nature: **KYKLOS 4.0 Marketplace and Brokering & Matchmaking**. These two components promote the capabilities that the KYKLOS 4.0 platform can provide to the end users in the Smart Circular Manufacturing sector. A critical factor for the project success is the **contribution of the components to KYKLOS 4.0 circular manufacturing capabilities** described below:

- **Shop Floor Cognitive Accelerator Hardware & Software:** Provides a common infrastructure to deploy reusable (i.e. reconfigurable) and resource-efficient edge computing solutions that reduce Shop-Floor-to-Cloud latency and increase energy efficiency.
- **Data Reduction Techniques & Fault Dependency Model:** It aims to increase process and resource efficiency when applied on tools for characterizing the health status of equipment, and to provide higher levels of efficiency at effective data provisioning and managing in reasoned decisions related to the usage of material.
- **Semantic Knowledge Base (SKB):** Facilitates knowledge exchange between systems and industries within a framework that is dictated by the Semantic Web principles.
- **Semantic Knowledge Base Service (SKBS):** Facilitates the adoption of semantic technologies by non-experts,

reducing the required degree of familiarity with the wide spectrum of these technologies.

- **Inference Engine:** Enables predictive maintenance that fosters sustainability of production and operation. Assures that previous data information is kept in the models, while enabling the efficient decision making on the Shop Floor.
- **Production Equipment Clustering:** Allows end-users to utilize the extracted knowledge for designing operations based on the machine-fleets that exhibit similar characteristics.
- **Maintenance Scheduler:** Schedules the maintenance for the equipment on time avoiding possible errors on the products, but also increases the life of the equipment.
- **Deep-learning (DL) Toolkit:** Used for product customization. 3D models of the product are developed first and are checked before going to production shortening the production loop and avoiding unnecessary production and customization processes. Also, the toolkit predicts failures extending the life of the machines in the Shop Floor, optimizing resources, and reducing costs.
- **Augmented Reality-based Re-configurator Tool:** Allows the operator to see in the same place information from different sensors, to see the status of a machine while interacting with the real-world and to take decisions resulting in the reduction of the costs.



Image by Gerd Altmann from Pixabay.

KYKLOS 4.0 Components' contribution to Circular Manufacturing

- **Automated Task Planner Toolkit:** Enables the use of custom production lines on small batches, with a high degree of personalization.
- **Rapid Prototyping Module (RPM):** Enables the fabrication of parts in a net-shape approach, supporting the user in the decision-making process when choosing materials and processes. Also, optimizes the material distribution inside the part to achieve optimal performance while simultaneously minimizing material consumption.
- **LCA Simulations Engine:** Collects, analyses, and monitors the sustainability performance of products, processes, and services. The tool measures the environmental impact across all life cycle stages of the product in (near) real-time through indicators and detects the hotspots, enabling the elaboration of comparative studies, the estimation of the progress over the environmental targets, and the continuous improvement in the production.
- **PLM Module:** The PLM Module enables the long-term product data availability by standard data model and format. Co-location of product data from many authoring applications.
- **Manufacturing Management Component:** Reduces the utilized materials of the customized products when all simulations are made in a virtual environment. This step reduces the products with errors in the testing phase, but also some parts can be reutilized for new products according to their 3D available visualization in modelling phase.
- **Blockchain-based auditing platform:** Contributes to the increase of security and trustworthiness through automating quality inspections, processes monitoring, and optimizing manufacturing processes.
- **Data Manager:** Enables a better view and understanding of the processes and how they are affected in terms of resource usage, energy usage and circularity KPIs.
- **Parametric Design Methodology:** Contributes to the reduction of time to market of customized products and of unnecessary manufacturing steps, as well as to reduction of fixing steps to regulate the customized product on user needs.
- **Recommendation Engine:** Enables the design and production of products ensuring minimum useless components and only the usage of necessary parts (materials).
- **Advanced Additive Manufacturing:** Provides AM materials database to the other components allowing the simulation, design, and analysis of the new products at their full cycle life.
- **Web 3D Modelling Component:** Assists to bring personalized products to market. These products by using AM agents can be produced on demand while keeping a low unit-cost and product lead times.
- **Augmented Reality-based Content Editor:** Reduces the time needed to perform a task or a maintenance process impacting directly in the production costs and the energy consumed by the machines. Also, allows the personalization in terms of information provided in the AR manuals as well as enhanced support in the assembly/operating/maintaining/fixing operations.
- **Virtual Production Line Orchestrator (VPLO):** Acts as an adapted workflow for new parts or third-party manufacturers of circular components and more circular oriented process steps (e.g. energy efficient machines). VPLO enables the integration of third parties in a reverse (remanufacturing) line: from scrap/waste leading to raw material for new production.
- **KYKLOS 4.0 Front-End:** Enables accessing the KYKLOS 4.0 Ecosystem and monitoring, recording, and updating the production processes.
- **KYKLOS 4.0 Back-End Infrastructure:** Offers data services allowing the development of circular production strategies, use models and value recovery models.
- **Decision Support System (DSS):** DSS has 3 main functionalities: a) short-term (operational) optimization, providing the user with suggested actions to achieve circular KPIs, b) long-term (strategic) optimization, assessing user's organization in circular objectives, and c) providing external users with targeted suggestions of KYKLOS 4.0 components.
- **KYKLOS 4.0 Interoperability Layer:** Offers data services allowing the development of circular production strategies, use models, value recovery models and supporting circular economy strategies.

KYKLOS 4.0 Components' contribution to Circular Manufacturing

- **Open SPHINX:** Provides data pipeline analysis and visualization for the verification and validation of circular economy strategies implemented by automation technologies.
- **Product Refurbishment Certification:** Offers the tracking of life cycle from production to sale, usage and back to repair/refurbishment, enabling the quality assurance and trust in re-usable products.

Given the nature of the project and its complexity, the validation of the technical components will increase over time.

Learn more about the current progress of the KYKLOS 4.0 components and use cases by watching the videos of the KYKLOS 4.0 demonstrators at our  [YouTube](#) channel.



Image by Gerd Altmann from Pixabay.

4. KYKLOS 4.0 Open Calls

KYKLOS 4.0 successfully organized the first of two Open Calls planned during the project with the objective of engaging European SMEs and manufacturing entities in the design and implementation of highly innovative experiments/prototypes using research infrastructure available within the framework of the project.

The KYKLOS 4.0 – Open Call #1 ran from 1 April 2021 to 30 June 2021. Leveraging an intense promotion campaign, including online events and social media marketing, the Open Call resulted in 47 proposals from 117 organisations from the EU and its H2020 Associated Countries. Of these 117 participations, 94 were from EU Member States and the remaining from countries such as Iceland, Norway, Serbia, Switzerland, and the UK.

The country with the highest participation was Italy, with 34 participations, and being present in 17 of the 47 proposals. Spain followed with 16

participations in 9 proposals and Greece with 11 participations in 6 proposals.

The Open Call allowed submissions from 2 or 3 partner consortiums. 23 proposals were submitted by 2 partner consortiums and the remaining 24 by 3 partner consortiums. Furthermore, 29 proposals were submitted with partners from the same country and the remaining 18 with partners from one or more different countries.

In addition to digital manufacturing, all proposals were required to address one or more of the defined sub-domains. Of the submitted proposals, two sub-domains – big data and data management and circular manufacturing – were present in 31 of the 47 proposals.

The seven selected projects, each receiving between €107.200 and €133.000, will kick-off their 6-month experiments on 1 November 2021. The projects will come to an end at the end of April in 2022.

Over this period, KYKLOS 4.0 will provide these projects with coaching and other support in view of maximizing their impact and value, but also that of KYKLOS 4.0. Selected projects will integrate KYKLOS 4.0 technologies in their own experiments, thus contributing to the validation of these technologies.

By the end of the 6-month funding programme, it is expected that these projects have made important steps toward the validation of solutions of value to the manufacturing industry.

A second open call will be prepared at the beginning of 2022 and will be tentatively launched in June 2022. A total of €2.000.000 will be available to fund 12 projects.

More information about the seven awarded sub-projects will be available online and in our next Newsletter.



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5. KYKLOS 4.0 Events

During the last months, the project consortium partners organized webinars and workshops to promote the KYKLOS 4.0 technologies, solutions, and Open Calls, and to exchange knowledge with the research community and industry stakeholders.

Digitalisation in manufacturing: SME Success Stories & Funding opportunities



On 9 June 2021, DIGITAL SME organized a KYKLOS 4.0 webinar on digital manufacturing, to discuss how manufacturing companies can optimize their production and supply chain processes by leveraging on digital technologies. Following a first part on success stories from SMEs providing solutions for the digitalization of manufacturing processes, the second part served as an info session about the KYKLOS4.0 Open Call #1, including a Q&A with participants on the application procedure.

Create your Digital Twin in days, not months, by using standards



On 27 & 29 September 2021, JOTNE organized a KYKLOS 4.0 workshop on Digital Twins & Standards, aiming to provide the participants with an overview of ISO 10303 concepts and how to integrate them with IoT. After an introduction on the PLM module, the IoT framework and application interoperability were highlighted. Participants had the opportunity to bring their own STEP files to test it out.

KYKLOS 4.0 at NAFEMS 2021



KYKLOS 4.0 partners CIRTES and JOTNE presented at the NAFEMS 2021 World Congress 25-29/10 their work ["The Standard Based Digital](#)

[Twin - Making the Foundation for Smarter Manufacturing and Creating Better Products"](#).

KYKLOS 4.0: Contributing on defining the fundamental design principles for Data Spaces



KYKLOS 4.0 along with other Data Space experts team up to define for the first time the fundamental design principles to build Data Spaces, across sectors and initiatives. More info [here](#).

KYKLOS 4.0 at IEEE Blockchain 2021



KYKLOS 4.0 will participate at IEEE Blockchain-2021, 6-8/12, Melbourne with the paper "A Blockchain-Based Audit Trail Mechanism: Design and Implementation".



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